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ARBORETUM BULLETIN

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TABLE OF CONTENTS

A Special Message ..... Col. Leroy Collins and Capt. Arthur P. Gardiner 1

Arboretum Annual Report ..... Joseph A. Witt 2

Arboretum Foundation Reports:
- Annual Meeting 5
- Unit Council ..... Lee Clarke 5
- Plant Sale ..... Louise Czerniski 6

Leaves From a Collector's Notebook:
- *Staphylea holocarpa* var. *rosea* ..... Brian O. Mulligan 7

Juki Iida 8

The John F. Kennedy Park ..... J.F. Durand 9

Kings Lake Bog ..... Betty Jo Fitzgerald 14

Garden Vignettes 23

Weather in the Arboretum 24

Stalking Ornamental Plants In China ..... Mark Ravenholt 25

Book Reviews 31

Seventh Annual Bulb Sale 32

Announcements from the Unit Council, Unit Council Governing Board, Calendar of Events 33

Active Directors and Honorary Board of the Arboretum Foundation; New Members 34

Classes 35

1976-1977 Arboretum Foundation Audit 36

COVER
Hydrangea aspera subsp. *aspera*
(See page 13)

Photo: Brian O. Mulligan

A Special Message

Fellow members,

It is with gratitude and humility that I assume this duty as President of the Arboretum Foundation. I am especially grateful for the expressions of support I have received, because without dedicated volunteers, progress would be impossible. Progress we will have.

I see this coming year as a time for opportunities for the Foundation and for the Arboretum itself. We have seen progress in recent years in the Foundation's relationships with governmental bodies, with community groups and with other organizations which cherish the Arboretum as we do. I plan to enlarge upon and improve those relationships. I hope to merit your trust in me.

I wish to call attention to the following article by our Treasurer, Captain (USN-Retired) Arthur Gardiner on the important matter of membership dues, and I urge you to adopt his suggestion for an upgrading of membership level as well as responding to the dues increase.

COL. LEROY COLLINS
Arboretum Foundation President

At the June Annual Meeting the members voted unanimously to amend Arboretum Foundation By-Laws to increase membership dues to the following new rates:

Life	$500	Contributing	$35-60
Sponsor	$100 & over	Sustaining	$20-35
Supporting	$60-100	Annual (individual)	$10

Group Affiliations (Garden Clubs, etc.) or Family Membership — $15 or more; persons under 21, or 65 and older — $5.

Regular membership dues increased from $5/year to $10/year, and Sustaining and higher classifications have been increased by $10 at the lower limit. The Executive Committee report which presented the need for an additional $30,000 of annual dues income stressed that each of the Foundation's 3000 members has to increase his dues support by an average of $10 to make the $30,000 goal.

The strong dedication shown by Foundation members in the past in working to meet Arboretum needs and goals suggests that a moderate approach should be taken in seeking additional operating funds. Accordingly, regular membership dues have been kept at a relatively low level so that membership is not priced out of anyone's reach. However, higher classification memberships are needed by two-thirds or more of the members to provide the operating income necessary to support our present Foundation organization.

Need for more dues income stems from heavy increases in Foundation operating expenses of recent years. These expenses for staff payroll, administrative costs and publications this past year were approximately $56,000. Income from dues and publications was a little over $26,000. The $30,000 difference is the increase in operating income that is needed. Present membership dues were set at $5/year when the Foundation was established in 1935. The new dues structure is the first change since then.

Traditionally, income from Arboretum Unit and Foundation activities, such as plant sales, bulb sales and donations, is spent in direct support of the Arboretum. Special projects, work and equipment which can not be funded from University sources, are financed with this hard-earned money which represents so many thousands of hours of volunteer work by Unit and Foundation members. This income is not considered to be Foundation operating income; therefore it is not used for Foundation operating expenses. Continuation of this policy is dependent on increasing dues income as necessary to match operating costs.

When you renew your membership remember to upgrade to a higher classification. Your faithful response is needed and appreciated.

CAPT. ARTHUR P. GARDINER
Arboretum Foundation Treasurer

ARBORETUM ANNUAL REPORT

June 1, 1976 — May 30, 1977

JOSEPH A. WITT
Curator of Plant Collections

The twelve month period covered by this report was in several ways most unique. First, a number of projects that had been hanging fire for from two to over ten years were finally brought to a successful conclusion, and secondly, the weather, especially for the last half year, was nearly unprecedented.

Perhaps the most important action from a long range view was the selection by the Joint Arboretum and Botanic Garden Committee of the landscape architectural firm of Jones & Jones to update the master plan of the Arboretum in Washington Park. This project, funded by monies from the State Highway Trust Fund, is intended to point out alternative directions that the Arboretum's program may take in future years. The Jones & Jones team are now intensively studying a number of possible developments (or non-developments) such as the building of a visitors center, renewal of the irrigation system, location and construction of special display gardens, suggestions for traffic control and circulation patterns for visitors on the grounds, as well as many other facets of Arboretum function. It was felt by the Joint Committee that, while the Olmsted plan of 1936 was still valid, there had been numerous changes in the 40 years since the plan was developed that could affect the Arboretum and its operation and that these changes should be considered in future planning. The only other updating of this plan was in 1966 by Sasaki and Associates and was concerned primarily with the impact on the grounds of the now defunct R.H. Thomson Expressway.

After a thorough review of the many problems facing the Arboretum and a series of public meetings to help the planners arrive at acceptable alternative solutions, it is expected that the update will be finished by the first of the new year.

Operations

A most satisfying accomplishment, at least for the staff, occurred when the Memorial Gates were finally installed on Arboretum Drive East just west of the greenhouses in November, 1976. These bronze gates were designed and constructed by Professor George Tsutakawa and their location was the center of some controversy for several years. To finally have the gates in place seems an achievement. Concurrently, two functional gates were placed at the north and south ends of Arboretum Drive East. These replace two cable gates that were removed three years ago because they were considered to be unsafe. The new gates are most welcome since they close the road to the nighttime traffic that had become such a serious nuisance.

Another welcome replacement occurred when the new bridge to Foster's Island was completed in March. This bridge is arched enough to allow canoes to pass beneath it whereas its predecessor was nearly at water level when the lake was high. The new structure was built cooperatively between the University and the Park Department and hopefully will set a precedent for future cooperation between the two institutions.

There have been other examples of the two working together especially at a somewhat lower level. The Park Department's tree removal staff spent over a month on the grounds removing dead and dying trees and pruning high branches that were beyond the reach of the University staff. Both crews worked together at this project as they did in installing posts along Arboretum Drive East to keep cars from running onto the turf and into the shrub beds. It is a sad commentary that such barricades are needed, but deep ruts in the grass and crushed shrubs gave us no choice.

The University staff spent much of the unusually dry winter clearing brush and weed trees from several overgrown sections. Hopefully future plantings in these areas will help to keep the brush under control.

The new native tree walk has been labeled although not all the trees have been planted. An illustrated brochure to assist in use of the trail is in preparation by a student, Irmgard Waring, and

should be ready for publication in the autumn.

This spring new fluorescent lights have replaced the old fixtures in the offices and the original wiring was renewed. This work was done after it was discovered that the existing wiring was no longer fire-safe.

Planting

Drought and anticipation of more to come kept plantings to a minimum this fall and spring. One small planting of 13 trees, however, represented a great step forward. On Arbor Day, April 13, 1977, these plants were set out in the Union Bay Teaching and Research Arboretum site. A small ceremony marked the beginning of what we hope will be continuing plantings for years to come.

In the Arboretum in Washington Park there were several noticeable additions to the collection. A group of moisture-tolerant trees including birch (*Betula*) and poplars (*Populus*) were set out at the north end of the open grassy area west of Azalea Way called the "Big Flat." On a steep bank above Azalea Way there is a shallow draw leading down from the Asiatic maple section to the flat below. This lovely sheltered fern-clad slope is now traversed by a trail and has been planted with a number of oriental maples. Next fall we plan to underplant these with a selection of large-leaved rhododendrons of the Grande and Falconeri series in an attempt to duplicate on a small scale the appearance of a temperate rhododendron forest in the Himalaya mountains of western China.

Other plantings include a small collection of spruce (*Picea*) in the Pinetum and a partial revision of the viburnum collection. In all, some 42 genera and 233 plants were set out, perhaps half the size of plantings of previous years.

Publications

After nearly twenty years of sporadic effort the catalogue of woody plants growing in the Arboretum compiled by Brian O. Mulligan has been completed and published. This volume, available in either hard cover or paperback, lists 4667 taxa, their scientific name, common names if any, country of origin, date of planting in the Arboretum and a grid reference to where they are growing. Complete through 1975, this 183 page book should prove a boon to all who want to know more about the Arboretum and its plant collections. Brian is to be congratulated on the successful conclusion of this highly complex project.

Educational Activities

The staff, largely Mr. Dean Powell, Mr. van Klaveren and Mr. Witt, gave a total of 34 lectures or demonstrations for the public. In addition, Mr. van Klaveren taught four continuing education classes while Mr. Witt gave two plus a graduate course in native woody plants. Two gardeners, Mr. Eddy and Mr. Egan, attended a pesticide school offered by the State Department of Agriculture and Washington State University. Mr. van Klaveren read a paper on propagation techniques of our new *Mahonia* 'Arthur Menzies' to the Western Chapter of the International Association of Plant Propagators in September. Mr. Witt served as co-chairman for the large international rock plant conference held in Seattle and Vancouver B.C. in July. In April he traveled to St. Louis, Missouri to attend a meeting of the American Association of Botanic Gardens and Arboreta.

Research

The Frost Hardiness Project continued with support from the Arboretum Foundation. The initial report appeared in this *Bulletin* Vol. 40, No. 1, 1977. The Arboretum's collections are continually being used for research purposes. Last year we sent herbarium specimens, living plants or seeds to about a dozen individuals or institutions for scientific study. In several instances we were told that we had the only available specimens of the particular plant the investigator was interested in.

Union Bay Teaching and Research Arboretum

The Board of Regents approved the Master Plan for the new development in May, 1977 which in essence blessed the Arboretum there. Two provisos were attached to the approval however: one, that an environmental impact statement must be filed with the proper authorities; and two, that the area containing the student housing be withheld from Arboretum use pending final disposition of the housing. There is considerable feeling among tenants of Union Bay Village that the housing be renovated rather than rebuilt elsewhere; hence this must be resolved before any major arboretum development takes place. We

plan to put in test plots during the fall of 1977 to begin learning how to best handle some of the problems we face in developing this unusual site.

Miscellaneous

Volunteers have been exceptionally active in the Arboretum program the past year, especially in the area of education and public service. The Japanese Garden Guides, for instance, conducted 40 tours for some 1050 visitors and in addition served as hosts and hostesses for over 250 delegates to the Garden Club of America's Annual Meeting in May. At the request of the Arboretum staff, a new dimension was added to the Native Walk Guides Program. After a series of training lectures and tours 26 guides were qualified to lead groups on general tours through the grounds. This new service now allows groups such as garden clubs to have trained guides available for Arboretum tours without using the over-extended staff. Between these and the native walk, some 70 tours were given to over 1800 people. Forty-two other volunteers served in the Arboretum office on Sundays from mid-March to mid-June. In addition, members of Unit 24 again mounted the Arboretum's colored slides and the Vivian Mead Unit distributed seeds for the International Seed Exchange.

The serious concern of the past two years over increased Arboretum traffic caused by the closure of East Prospect Street just west of the Japanese Garden was somewhat alleviated by changes made in street use by the Seattle Engineering Department. While traffic is still heavier than in 1975 and 1974, there seems to be a reduction in volume over that recorded in 1976. The problem of traffic through the Arboretum is far from being solved, but there have been positive steps taken by all involved parties.

Actions taken by the Joint Arboretum and Botanic Garden Committee culminated in the purchase of somewhat over three acres of land for the Arboretum in Washington Park. The largest parcel was the so-called "Pit." This property was part of the right-of-way of the R.H. Thomson Expressway and is strategically located at the north end of the Arboretum, bounded by East Lynn on the south, 26th East on the west, Lake Washington Boulevard on the north and the Arboretum on the east. Just how this tract will be integrated into the Arboretum has yet to be determined, but hopefully whatever is done will improve the north entrance to the Arboretum. A much smaller piece of land west of the Japanese Garden was acquired at the same time. It contains the source of the stream in the Garden, and it was felt that the property should be purchased to protect its headwaters.

Plant and Seed Exchange

The Arboretum uses its surplus plants and the seeds collected during the autumn in a similar manner as zoos use their surplus animals; we trade for material needed to improve our collections. Last fall and this spring we sent out over 200 plants to other North American botanical gardens and arboreta while over 200 institutions world-wide received some 3200 packets of seed. In return we requested and received over 500 kinds of plants as seeds or living plants from 90 other gardens and individuals.

In addition to the usual exchange we received two gifts of rhododendron collections. The first, from Dr. Bruce Bartholomew, University of California Botanic Garden, Berkeley was a number of seedlings from seed collected in the wild in the Himalaya mountains. The other was a collection of 30 rhododendron species and hybrids from the garden of Dr. Catherine Owen. These include a number of large-leaved species which will go into the new Himalayan-western Chinese planting mentioned above.

Weather

The dry and mild winter of 1976-77 will probably join November, 1955 in the weather-oriented folklore of western Washington gardeners. As can be seen in the weather record below, the Arboretum's rain gauge showed a shortage of about 15.75 inches of precipitation for the period June 1976 through May 1977. The real deficit came in the fall and winter when only 6.24 inches were measured for November through February, when normally we can expect 22.97 inches. Fortunately the rains in March and May were above the 20-year average. The City of Seattle's Water Department tells us it has an adequate supply of water to permit the usual irrigation during the dry part of the summer.

We have started keeping our weather measurements in metric mode anticipating the inevitable change. The record of rainfall and temperatures in the Arboretum during the past year appears on page 24. ♠

Highlights of the Annual Meeting*

The annual meeting of the Arboretum Foundation took place on Friday, June 10, 1977. In his introductory remarks, President N. Stewart Rogers noted that Foundation membership has for the first time exceeded 3000.

Treasurer Arthur P. Gardiner presented the financial report, explaining the need for a dues increase. He reaffirmed the financial health of the Foundation, however, emphasizing that during the year 1976-77 more than $50,000 was donated for the improvement of the Arboretum as well as $22,000 loaned to the University Press for the reprinting of the *Vascular Plants of the Pacific Northwest.*

Joseph Witt, Curator of Plant Collections, gave a brief, optimistic report on the status of the Arboretum, which appears in greater detail on page 2.

In his President's Report, Mr. Rogers said that it was a privilege to have worked with such unusually competent and dedicated people, and he thanked all the officers and standing committee chairmen who had served with him during the last three years.

He stated that during this time the relationship between the city and the university has gone from blatant controversy to cooperation. He quoted Mike Lowry of the King County Council who has commented that interest in the Arboretum extends not only to the residents of Seattle but to all the people of King County as well.

President Rogers requested and received from the membership a reaffirmation of the priorities which had been adopted in 1975. These have been brought to the attention of Jones & Jones, who are now engaged in drawing up a master plan for the Washington Park site of the Arboretum. Peter Harvard of Jones & Jones stated that he would be glad to receive additional comments from Arboretum Foundation members in his office.

The change in by-laws relating to the dues increase was proposed and passed by the membership (see p. 1).

Jack Hirsch, Garden Manager of the Rhododendron Species Foundation, presented an interesting slide program describing the history of the Species Foundation and its final location on the 27-acre site provided by the Weyerhaeuser Company.

The final event of the evening was the report of the nominating committee, chaired by Robert Behnke, and the election of new officers and directors (see pp. 34 and 35). Outgoing President Rogers presented the gavel to new President Col. Leroy Collins, and the meeting was closed.

*The annual audit is to be found on p. 36. Full reports of the Nominating Committee, the Treasurer and the Unit Council Chairman are on file in the Arboretum Foundation office.

Annual Report of the Unit Council

Another busy year for the Arboretum Foundation Unit Council has drawn to a close with an increased unit membership from 1453 in 1976 to 1477 in June, 1977. We welcomed two new units into our midst: #91 from Bainbridge Island and #92 from Mercer Island.

The Unit Council donated $17,000 to the Arboretum from Plant Sale profits and other sources. In addition, individual units gave $3018 to the Arboretum and $695.49 to the Unit Council for internal use.

The Unit Council Greenhouse has had a busy and rewarding year. A series of department heads was set up with Units 68, 41, 24 and 17 helping on a regular basis. Nearly 2300 plants were sold from the greenhouse this year for a total of almost $2000. An additional $237 was received from the sale of the *5th Tuesday Cookbook,* compiled by greenhouse workers. In addition our Education Department sponsored six cutting parties at the greenhouse during the summer.

Two botany courses were given during the fall and winter by Dr. Janet Hohn at the University of Washington. She was also our guest speaker at the September Unit Council meeting with a short program on "Kitchen Botany." Other programs for these quarterly meetings were: "Gardening as Therapy for Children" by Dr. Raskin from the Children's Orthopedic Hospital, and a documentary film on protecting the environment called "Use it, Use it up."

This year we embarked on a new plan for involving all the units at the district level. Each Dis-

trict Representative planned a project for all the units in her area to interest not only Foundation members but the public as well. A great variety of programs emerged:

"Winter Color in the Garden" by Ed Hume.
All-island tea on Bainbridge Island, with a talk by Joe Witt on the Union Bay Arboretum.
"All you want to know about Houseplants" on Mercer Island, presented by Houseplant Unit 84.
A tour of the Rhododendron Species Foundation Garden at Federal Way.
A workshop and demonstration exhibit about the Arboretum at the West Seattle library.
A tour of the Ste. Michelle Winery in Woodinville.
A tour of two lovely Woodway Park gardens in Edmonds.
A tour of the Bloedel Reserve on Bainbridge Island.
A Gardening Encounter — or a Work and Fun Day at the Arboretum in June.

The Explorers' Walks, held every fourth Wednesday of the year except December, continues to be a popular public service project of the Unit Council. It is usually led by Bob Van Denburgh or Brian Mulligan, who have made these excursions a real treat for all who participate in them.

Perhaps our greatest service to the public is our guide program. All groups of guides were treated this year to a series of training tours throughout the Arboretum led by Joe Witt.

The Native Walk and general Arboretum guides had a total of 70 tours led by 119 guides for approximately 1810 guests. Requests came from 27 areas: local Seattle communities as well as other areas of King County, and some from as far away as Oak Harbor, Olympia, Everett, Puyallup, Vancouver, B.C. and even Belfast, Ireland. The Garden Clubs of America Convention had a special tour by bus for 250 members, ending with a walk through the Japanese Garden led by a group of our specially trained guides. In addition our 13 Japanese Garden guides hosted 450 children and 600 adults on other visits to the Garden.

Over 800 children in 16 schools have been visited by our school guides who have taken native material to classrooms and held orientation programs for outdoor trips. Thirty-four visits were made to Children's Orthopedic Hospital, Group Health and Arden Nursing Home to bring in a touch of the outdoors to these shut-in children and adults.

The Herbarium Committee was invited by Pacific Search to display some of their mounted specimens at the Hilton Hotel. An herbarium cabinet has been ordered to store and preserve their fine specimens.

The Fall Bulb Sale netted more than $6000. This year over 36 workers filled approximately 600 orders, sending bulbs all over the United States and even to Perth, Scotland. The lovely display of our spring bulb bed near the Arboretum office is a delight to the Arboretum visitor.

The 30th Annual Foundation Plant Sale was a greater success than ever. The Plant Sale Chairman's report follows this one.

Without our Unit Council Quarterly, we would be unaware of the many goings-on in our organization. For this reason we send it to all Arboretum Foundation members.

I hope many of you enjoyed this year's activities with us, and my thanks to all of you who helped me during the last two years while I have been Unit Council Chairman.

LEE CLARKE
Unit Council General Chairman, 1975-1977

Plant Sale Report

Over 480 workers joined together with enthusiasm and good spirits to make our 30th Annual Plant Sale a great success. Our gross was a record $37,730. However our expenses were high too — approximately $19,600 — leaving a net of $18,130. I believe our prices were on the whole not noticeably higher than they were in 1976, but many of our suppliers' prices were, and some did not give as generous discounts as they had in the past.

So, looking forward to 1978, let's all think donations — which are all profit. Now is the time to begin preparing suitable material which will be healthy and properly potted and labelled for next year.

All in all it was a wonderful sale and I hope it was as happy an experience for all the other workers as it was for me.

LOUISE CZERNISKI
Plant Sale Chairman, Spring 1977

Photo: Brian O. Mulligan

***Staphylea holocarpa* var. *rosea* flowering in the Arboretum in mid-April, 1977.**

Leaves from a Collector's Notebook

BRIAN O. MULLIGAN

Staphylea holocarpa var. *rosea*
Rehder and Wilson

"Very common on the margins of woods and thickets in western Hupeh and eastern Szechuan and the most beautiful species of the genus. Though usually a large bush it very often forms a shapely tree from 8 to 10 meters (26 to 32 feet) tall, with a slender trunk clothed with smooth grayish bark." (E.H. Wilson, in *Plantae Wilsonianae,* IV, 186, Cambridge, Mass., 1914.)

"This promises to be one of the best of Mr. Wilson's introductions owing to the extreme grace and delicacy of the coloring of its panicles and to its free flowering in good years . . . The plant is perfectly hardy and should not be more difficult to grow than the common European bladder nut." (Otto Stapf, in Curtis' *Botanical Magazine,* CLI, t. 9074, London, 1925.)

These two comments, the first by the famous plant collector who introduced it in 1908 to western gardens through the Arnold Arboretum, and the second by the botanist who gave a full account of the plant and its history when it was illustrated for the *Botanical Magazine* 11 years after the former publication, give an indication of the quality and potential value of this shrub which seems to be taking so long to reach nurseries and gardens on the Pacific coast, where it should thrive.

So far as I know, the first introduction to the Puget Sound area was made by the late Donald G. Graham of Seattle, who imported a plant from Hillier's Nurseries, Winchester, England about 1946 or 1947. This plant is still in existence in his garden in Broadmoor; it is now about 15 feet tall, although the main trunk was severely damaged some years ago apparently by some fungal infection.

Seeds were received by the Arboretum in 1952 from the garden of Sir Frederick Stern, near Worthing, Sussex, England. From these only one seedling was raised to planting size. It was placed in the Winter Garden area but the site was too wet and it died in 1971 or 1972.

A second acquisition of seeds received in December, 1960 from Mr. F.J. Williams of Caerhays Castle, Cornwall, England proved more successful and at least four plants survived to be set out in three different locations in the Arboretum between 1968 and 1971. However, the only

one of these that has become established and reached flowering size is in a rather shady bed on the west side of Arboretum Drive just north of Rhododendron Glen. It grows beneath a large native maple *(Acer macrophyllum)* with several bushes of *Osmanthus suavis* and *Berberis linearifolia.* It is now about nine or ten feet in height and nearly as wide with an open and more or less horizontal branching pattern.

This specimen flowered sparingly for the first time in 1972, a year after planting, but in mid-April, 1977 it bloomed freely all over the branches. At this time, when the young leaves are only just unfolding, it is quite a conspicuous feature for a week or more. Wilson's field notes indicate that it usually flowers in May in the wild.

Five to eight more or less campanulate flowers are borne in loose glabrous inflorescences. The sepals and petals, each five, are very similar except that the sepals are slightly shorter; the white petals form a cylinder around the five stamens and the style. The flowers are tinted pink in the bud and have no appreciable scent. Apparently they are self-sterile since the plant has produced no fruits. These are described as being pear-shaped, inflated capsules about 2 inches (5 cm) long, 1 inch (2.5 cm) wide, containing a number of hard, round shining seeds.

The trifoliate leaves are arranged oppositely on the smooth green shoots. The lower leaf of each pair is distinctly larger, having a longer petiole than the upper ones — at least on this plant. The leaflets are 2.5 to 3.75 inches (5.5 to 9.5 cm) long and about 1 inch (2.7-3 cm) wide. They are ovate-lanceolate, short-acuminate at the tip, with a wedge-shaped base. The margin is serrulate (finely toothed) down almost the entire length. The upper side is dark green, the lower much paler and glaucescent, the veins conspicuous on both sides but raised beneath, where there is some pubescence continuing down the short stalks.

The name *Staphylea* is derived from the Greek word for a bunch of grapes, *staphule,* no doubt referring to the pendulous inflorescences of the first species described by Linnaeus in 1753, the European *S. pinnata,* which occurs throughout central and southern Europe, from France to Turkey.

For one small genus of shrubs or small trees in the northern hemisphere, *Staphylea* has an interesting distribution pattern. Farther east in the Caucasus region is found *S. colchica,* probably the most handsome species because of its long panicles of white flowers in May. There is one species in the western Himalaya and central China, *S. emodi,* which is not in cultivation so far as I am aware. Our *S. holocarpa* is native to western and central China. *S. bumalda,* the easternmost species in Asia, is found from central China through Manchuria and Korea to Japan, where it occurs throughout the islands.

In North America we have: *S. bolanderi* in the foothills of the Sierra Nevada in California; *S. pringlei* in northeastern Mexico; and *S. trifolia* which ranges from southwestern Quebec to Minnesota and south to Arkansas, Alabama and Georgia.

Besides *S. holocarpa* var. *rosea* the Arboretum possesses *S. colchica, S. pinnata* and *S. trifolia.* Most of these are located on the west side of Azalea Way south of Loderi Valley and near the ash *(Fraxinus)* collection. There is also a large old plant of *S. pinnata* beside the nursery road, near the Broadmoor fence.

All these other species flower during May, however, when the new foliage is well-developed, thus nearly hiding the tassels or bunches of blossoms. But if picked or examined closely, they are certainly both attractive and interesting.

Propagation by seeds extracted from the bladder-like fruits and sown outdoors in a container in October or November should be successful. ♠

Juki Iida

Those who treasure the Japanese Garden will be saddened to know that its creator, the landscape architect Juki Iida, died in Tokyo in June at the age of 88. A future issue of the *Bulletin* will have a memorial article which can do justice to his work here as well as to his active career as the designer of over 1000 gardens throughout the world.

Photo: J.F. Durand

Entrance to the John F. Kennedy Park

The John F. Kennedy Park

New Ross, County Wexford, Ireland

*J.F. DURAND**

The many bonds linking Ireland with the United States were further enhanced in the foundation of the John F. Kennedy Park. It sprang from the tragedy of President Kennedy's death in 1963, which drew an immediate response from Irish interests in the United States, and within a month, contributions were pledged towards the creation of a memorial in Ireland. The decision to create an arboretum in his memory found favour on all sides and so a long felt need began to be fulfilled.

Interested parties had long pressed for an arboretum. The National Botanic Gardens at Glasnevin, Dublin, since its initiation by the Royal Dublin Society in 1790, had attempted to maintain a collection of trees and shrubs, but limitations of area alone — 19 hectares[1] — would abort any ideas of its being comprehensive in range.

A planning committee was quickly established for a new arboretum, representative of the Department of Agriculture, which is responsible for the National Botanic Gardens, and of the then Forestry Division of the Department of Lands, now the Forest and Wildlife Service. Another Government Service, the Office of Public Works undertook design of buildings and services.

Funds

In responding to the splendid initiative the government guaranteed to provide the additional funds necessary for development and maintenance. The American sources raised a sum in excess of their original pledge and contributed about 65,000 pounds which, as it happened, was about the price paid for the land. The project has

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*Dr. Durand is Director of the John F. Kennedy Park.

[1]All measurements are in metric units. Equivalents are given below:
1 km = 0.62 miles
1 m = 39.37 inches
1 cm = 0.39 inches
1 mm = 0.04 inches
1 hectare = 2.47 acres

Photo: Cork Examiner

Lilac collection and lower section of the ericaceous garden with eucalypts and limes *(Tilia)* beginning to show in the middle distance.

been otherwise funded and managed by the Forest and Wildlife Service.

The Site

A suitable location was the first requirement for the new arboretum. At this time a farm of 158 hectares, situated in the very parish in which the Kennedys had farmed, was in process of acquisition by the Irish Land Commission, on the lower slopes of Slieve Coiltia — which translates aptly to the Mountain of the Woods. A soil survey by an Foras Taluntais (The Agricultural Institute) showed the soils to be largely Brown Earth and very suitable for the purpose. The basic rock is Ordovician Shale and the soil has a pH ranging from 5.7 to a high of 6.9 where liming had been a feature in the farming operations. Situated about 15 km from the sea, the general aspect of the area is southwesterly and the elevation ranges from 36 m to 190 m above sea level.

Planning

Thus, in July, 1964 formal possession was taken of the lands. With this farm, and the later addition of a further farm of 28 hectares extending up the slope of Slieve Coiltia, the planned distribution of land was decided as:

(a) 108 hectares for Specimen Trees and Shrubs and Amenity Areas
(b) 56 hectares for Forest Plot area

An area of 21 hectares was reserved for a proposed Horticultural School, which eventually did not proceed, and the area was incorporated as an extension area in the arboretum.

The allocation of space among different families and genera was done by Mr. Aidan Brady of the National Botanic Gardens, where he is now Director, and Mr. Tony Hanan who was to become the first Director of Kennedy Park and who died most prematurely in 1972. To Mr. Hanan and his assistants fell the work of planning positions of the actual specimens, and the necessary advance plotting and map recording.

The views of relevant university departments were invited and biennial meetings on site have been a continuing feature to discuss views on planning and progress.

It was reckoned that in forming a comprehensive collection of trees and shrubs to grow in Ireland, up to 6000 species would be included of which about 4800 would be shrubs and about 1200 would be trees. When one considers the number of specimens which it would be desirable to include from the sub-species and varietal ranks, the figure of 6000 could be quite conservative.

Layout

The layout of the specimens was arranged on the Engler and Prantl[2] system of botanical classification with some modifications for practical reasons. For example, the currants (*Ribes*) were moved to avoid proximity to the five-needled pines because of rust.

In the forest plots the layout was decided on a geographic basis. This gave a variety between evergreen and deciduous species and positioned the most commonly planted species conveniently close to each other. It was reckoned that about 250 species would be represented in the plots eventually.

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[2]Although the Engler and Prantl system of botanical classification is now considered obsolete, it is still in common usage because so many important herbaria and floras have based their arrangement upon it.

As a precursor to the planning, a party had visited various well-known arboreta, including Seattle, to assess the most suitable approach to classification, recording and the countless other aspects of such an undertaking, ranging from labels to libraries. Mr. Hanan also paid visits to arboreta in Britain and France to gain a better understanding of espacements in conditions more similar to our own.

The system of mapping and location records was based on that used at the Arnold Arboretum. Numbered concrete markers have been spaced at precise intervals throughout the area and positioned at grass level. Each individual plant can then be given a reference to these markers.

Wind Shelter[3]

In planning the arboretum it was recognized from the beginning that special shelter would be necessary. After discussion of the possibilities of overall planting and the placing of specimens in this matrix it was decided to limit the shelter to a series of planted screens together with perimeter belts and some internal blocks. The screens have been placed at distances from 35 to 50 metres apart and their composition is generally Japanese larch (*Larix kaempferi*), red oak, (*Quercus rubra*); and Lawson cypress (*Chamaecyparis lawsoniana*) in a double line mixture. More latitude as to species was taken in the perimeter screens and blocks and use was made of *Eucalyptus gunnii, E. delegatensis,* red alder (*Alnus rubra*), *Populus* × TT 32, Norway spruce *(Picea abies)* and sycamore maple *(Acer pseudoplatanus*) both in mixture and in pure groups. Since planting in 1965 and 1966, these shelters have contributed greatly to reduction of the wind effects.

[3]Because of its location near the coast of southeastern Ireland, the Kennedy Park is exposed to strong winds from the sea.

Planting

After discussion of the pros and cons of planting single specimens, it was decided to plant three of each plant at a sufficiently wide spacing to allow for the development of mature canopy. For purposes of study and appreciation of a tree or larger growing shrub, a full, free and unhindered canopy was planned. For smaller shrubs, these were likewise to be planted in groups of three, or sometimes more in number, to give a better visual impact and mutual security and support.

Plant Supply

One of the first steps taken in the supply of plants was to seek the cooperation of governments with whom Ireland had diplomatic relations, and a great many countries replied with indigenous plants, representative of particular species and provenances.

The supply of plant material for forest plots is arranged generally through research organisations or institutes to provide authentic material and reliable records. For specimen shrub material contacts have been developed with better-known nurseries, largely in Ireland and Britain.

Artificially created lake with *Cryptomeria japonica* 'Elegans' in the foreground. Note young plantings in the distance.

Photo: *Cork Examiner*

Amenity

In planning for a scientific collection, the aim was to mould the whole into an attractive creation and so more readily to appeal to visitors. The two circuits of gymnosperms and angiosperms were thus interwoven for scenic effect and the individual collections were arranged to show the more attractive taxa to best advantage from adjacent roads or paths.

As the area is not generously endowed with water features — though there is an attractive glimpse of the estuary of the Three Sister Rivers some 5 km away — emphasis has been placed on what small streams occur. These have been realigned and reshaped to provide a small lake and a number of ponds and lots of twinkling cascades. A flock of up to 100 mallard are free flying from the lake where they are fed and are a most popular feature. At the moment there are seven mute swans visiting and are associating easily with the ducks and the pair of brent geese which were brought in last year. Parties of school children are invariably captivated by the lakeside activity of the birds in late spring with fussy mother ducks followed by scrambles of ducklings.

The design of the long, low, building complex was executed in panels of stone work between timber framing of western red cedar. The stone is an attractive buff-grey bedding stone from Liscannor, County Clare, which also provided the extensive area of limestone paving for the terraces, while tablets of Connemara marble are used as flooring in the main lobby. On the terrace is placed the Memorial Fountain of Wicklow granite with President Kennedy's inaugural message 'Ask not what your country can do for you, . . . ask what you can do for your country,' in both the Irish and the English language.

While motor cars are normally excluded from using the arboretum roads, visitors can drive to a Viewing Point on the slope of Slieve Coiltia which, from a height of 190 m, commands a fine view over the lands southwards to the sea and westwards to the distant Comeragh Mountains.

Experience to date

Our average rainfall has been 1000 mm and though there can be an excess of evaporation (open pan) over rainfall as high as 360 mm during the period March to August, plants have not suffered. In each of the last two years we have been spared the strong desiccating winds normally associated with spring and increasing shelter is providing a much better environment.

Instruments have been positioned throughout the arboretum to monitor the results of shelter development and these have shown marked benefits, even from the early years. By 1976, for example, when the effective height of shelter was still only 6 m, instruments positioned on an average of 20 m on the leeward side from the prevailing southwest wind, registered 123 km wind run for 24 hours, compared with 372 km on an unsheltered instrument, read as a control. It is of interest that when these instruments were recording these values at 2 m above ground level, another instrument positioned 22.5 m above

The shelter and trellis with *Polygonum baldschuanicum*. *Pieris* and *Erica herbacea (E. carnea)* in front.

Photo: J.F. Durand

Lobby of the main building. Floor in tablets of Connemara marble, ceiling in Parana pine. Photo: *Cork Examiner*

ground level recorded 562 km for the same period at the same location.

Last August saw the highest recorded screen temperature to date, 28.1°C in an exceptionally hot summer. Our lowest screen temperature has been −6.5°C and our lowest grass temperature has been −13.2°C.

We have more than 100 days of frost a year and generally frost is recorded in each month other than July and August. But frost is not a great problem because of good topographic gradient and southwesterly aspect, though we can have some damage from autumn frost to Lammas (late) growth on *Quercus* and *Castanea*. A cold spell last winter when temperature dropped to −11.1°C and culminated in 10 cm snowfall with freezing conditions caused frost burn on the tips of a wide range of material for example *Euonymus, Buxus* and *Myrtus*. *Eucalyptus globulus* foliage suffered browning and desiccation but the specimens will survive.

An exceptionally fierce southwest storm in January, 1974 caused a great deal of salt burn and defoliation to a wide range such as *Eucryphia, Garrya, Berberis* and even several provenances of Scots pine *(Pinus sylvestris). Ligustrum* hedging, normally evergreen with us, was also defoliated, but it is always surprising how the effects of storm damage can be quickly overcome.

Progress to date

We have now over 3700 taxa represented on the ground and more than 150 forest plots. Already there is a feeling of maturity in some of the collections such as *Hebe* and *Spiraea,* and some thinning has been done, twice in both red alder *(Alnus rubra)* and Italian alder *(Alnus cordata).* The latter has proved the fastest growing species of any, registering 10.5 m plot height in nine years.

On the other hand collections such as oak look very thin and sparse on the ground and it will be many years before many of the tree collections begin to really occupy the space allotted to them. As the beneficial effects of wind shelter are becoming increasingly apparent, we can afford to look forward to the planting of such genera as *Magnolia, Sophora, Dacrydium* and *Acacia.*

When visitors come in their numbers — about 80,000 come each year — and the main summer flowering peak is reached, the young arboretum makes a glorious show of its achievement thus far and gives promise of future riches. ♠

Cover Photograph

Hydrangea aspera D. Don subsp. *aspera**

This most useful and attractive shrub flowers in August when little else is in bloom except for the eucryphias and some heaths and heathers. It will flourish in any garden that has a well-drained soil suitable for rhododendrons, azaleas and other hydrangeas. A shaded situation in the afternoon is desirable.

The minute fertile flowers in the center of the flat, terminal inflorescences have lavender-blue petals and stamens. These are surrounded by a ring of large white to purplish sterile flowers which dry and persist until late fall or early winter.

Plants can be seen in the Arboretum amongst other hydrangeas just south of the head of Rhododendron Glen, beside the large specimen of *Franklinia.* Planted in 1953 and 1954, they are now six to seven feet tall and flower freely every year. Propagation can be accomplished by cuttings of non-flowering wood taken in late summer.

This subspecies was first found in Nepal in 1802. Its range extends from there eastwards into Burma, through many provinces of China, in the mountains of Taiwan and even as far south as Sumatra.

BRIAN O. MULLIGAN

*Synonym: *H. villosa* Rehder. Cf. reference to *H. aspera* subsp. *sargentiana* on p. 26.

Photo: Nancy Walz

Kings Lake Bog

A Description of Its Vegetation and Microenvironments

BETTY JO FITZGERALD *

Introduction to Kings Lake bog

After much stumbling and backtracking on an overgrown angler's trail, we broke through the hardhack swamp to find Kings Lake bog, quiet in its pristine beauty. With that first glimpse in 1963, I resolved to take on a study of this beautiful, isolated bog. Kings Lake exhibited all the characteristics of a bog community that so fascinated me: the floating sphagnum mat, the unique plants, the distinct successional zonation.

I stood on the bog surveying the pictorial record of the death of a lake, thinking about the historical record that was underfoot. I wondered what changes in climate and flora had been recorded in the layers of accumulated peat.[1] Could it yield a perfectly preserved man 2000 years old, as the Tollund bog in Denmark has? Thoughts of the past gave way to those of the present as I explored the bog, looking for clues to explain the pattern of vegetation.

Tsuga heterophylla (western hemlock) was the dominant conifer on the bog; its seedlings were noticeably abundant on the floating sphagnum mat. There were only three specimens of *Pseudotsuga menziesii* (Douglas fir) and six of *Picea sitchensis* (Sitka spruce). No pines were present even though they grow in other Washington bogs. Such observations precipitated the questions I eventually tried to answer: What are the mechanisms by which a bog achieves and maintains its characteristic appearance and flora? What is inhibiting invasion of forest conifers?

Outline of investigation

My course of study began with a review of the extensive literature on bogs.[2]

The next step involved a description of the vegetation on Kings Lake.

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*This in-depth study of Kings Lake bog is a natural sequel to the general article on bogs which Betty Jo Fitzgerald wrote for the preceding issue of the *Bulletin* (Vol. 40, No. 2, p. 2).

[1]M. Tsukada (University of Washington Botany Department and Laboratory of Palynology) studied the vegetational history of the area through pollen analyses of core samples from Kings Lake bog in 1969.

[2]See Fitzgerald (1966) for a comprehensive literature review; general references are included in this article.

Since temperatures of the bog microclimate seemed an important factor, temperature stations were established and records compiled for two successive seasons — 1964 and 1965.

Seed traps were set out to determine the kinds and numbers of propagules falling on the bog.

The final phase of the study involved field plantings of conifer seeds. It was hoped that the data obtained from their germination and survival would yield a significant measure of the effect of the microenvironment upon the establishment of the invading flora.

Literature review

Some generalizations from the bog literature can be made. Bogs of temperate North America accommodate a characteristic flora (see preceding issue, p. 4, Fig. 2). One can find a carpet of sphagnum moss and sundew beneath a dense cover of cranberries, bog laurel, Labrador tea and stunted conifers on any bog from Maine to Washington. The successional order in which these characteristic plants overtake a bog lake was discussed in the aforementioned article.

The chemical components and characteristics of peat have received much attention in bog studies. Bog substrates are highly acidic (pH 3.5 to 4.8) and poorly oxygenated, conditions discouraging microbial action. Consequently bog substrates are considered nutrient-poor. Rainwater and outwash from uplands are the sources of minerals in a bog. Aeration of peat reduces acidity and encourages decay, releasing nutrients.

Of all bog characteristics, acidity was thought to be the most potent selective force, until several investigators showed that pH in the transition zone is as low as that on the bog proper, indicating that tolerance to high acidity is well developed in potential invaders of bog lands. Lötschert (1963) recorded a pH of 4.2 in the rush-sedge zone and a pH of 3.4 in the surrounding transition forest. Fitzgerald (1966) measured pH in those zones as 4.1 and 3.7, respectively.

A second school of thought proposed that the climatic conditions of bogs accounted for the distinct flora. Most of the plants, with the exception of the insectivorous species, were known to be northern relicts that seemed well-adapted to cool, soggy conditions. A bog was like a wet sponge, continuously evaporating and cooling the areas above the sphagnum cushion. Cox (1910), Rigg (1947) and Moizuk (1965) found that air temperatures at night in a bog were considerably lower than the temperatures in the surrounding uplands.

Rigg felt there were three possible ways in which temperatures influenced the growth of bog flora: through low minimum air temperatures, through large sudden changes in air temperatures and through high air temperatures at times when the soil temperatures are comparatively low. For example, bog plants have roots in peat where low temperatures retard nutrient exchange and growth, yet their topsides are exposed to direct sun and high temperatures which encourage rapid transpiration. Such harsh extremes demand the special adaptations seen in bog plants. For example, Labrador tea, bog laurel and cranberry have one or more of the following characteristics: leathery leaves, revolute leaf margins or an

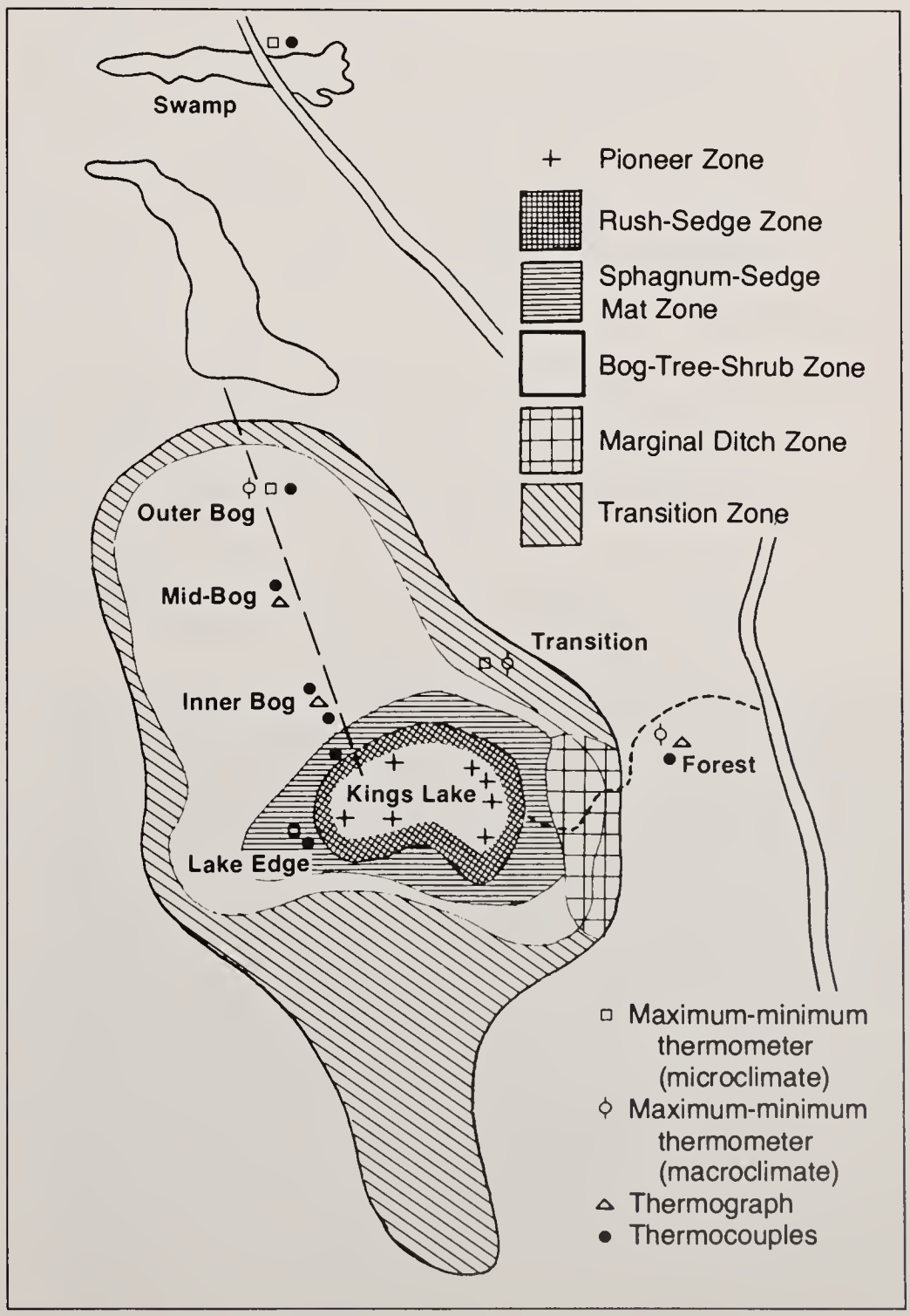

Fig. 1. Diagram of the Kings Lake area showing vegetation zones and the location of temperature stations within the zones. (The thermometers and thermographs were recording the microclimate at approximately 10 cm above the ground. Those recording the macroclimate were placed 2 m above the ground. Each thermocouple symbol represents one plexiglass stake which bore 5 thermocouples; each thermocouple was buried in the surface layer of a different substrate.)

indumentum protecting the evaporating surface. It is interesting that these same features are adaptations for drought resistance and frost hardiness according to Leavitt (1951). So it would seem that temperature conditions play a role in selecting for the flora.

In summary, the demands upon bog plants come from two areas: the substrate and the microclimate. I chose to characterize the microclimates of Kings Lake bog in an effort to explain existing patterns of vegetation. I hoped conifer seed performance would correlate with microclimatic variations within the bog.

Location and description of Kings Lake bog

The site occurs in King County at an elevation of 950 feet. It is owned by the Weyerhaeuser Timber Company, and access is via logging roads which start at the millsite north of the town of Snoqualmie. The unmarked trail enters the bog at the east side of the lake; the last 300 feet is traversed on felled logs through a dense thicket of shrubs. The area studied lies to the northwest of the open water and is frequented by black bears foraging for berries.

The lake is 2.8 acres in area according to Wolcott (1961) and surrounded by 52 acres of peat bog. The water is coffee-colored and murky. Algae proliferate and have been identified by the students of Dr. R.E. Norris (University of Washington, Botany Department). The pH of the lake water is 5.9 to 6.0; its depth off the floating mat measures 14 to 15 feet. The lake drains sluggishly from the west-southwest end through a channel to Tokul Creek.

The bog and surrounding areas were logged 41 years ago. It is suspected that, at that time, the slash was burned; fire scars seen in growth-ring analysis of living stems suggest that the bog burned many times before the advent of white man.

Cladonia rangiferina, a brittle lichen that grows in large patches on the sphagnum-sedge mat. Reproduction less than full size. Photo: G. Pirzio-Biroli

Aspect of the vegetation

Seven vegetation zones are distinguished by different plant communities in the bog area. A generalized vertical profile of each zone appears in the preceding issue (p. 3, Fig. 1); the approximate orientation of these zones around Kings Lake is diagrammed in Fig. 1. The following brief description of each zone includes dominant plants only:

PIONEER ZONE: The bog mat advances over the surface of the water via the woody shrubs, *Ledum groenlandicum* (Labrador tea) and *Kalmia occidentalis* (bog laurel). Two herbs, *Potentilla palustris* (marsh cinquefoil) and *Menyanthes trifoliata* (buckbean) are less important pioneers. The emergent shoots are often three feet beyond the mat edge.

RUSH-SEDGE ZONE:[3] Consisting of clumps of rushes and sedges emerging from the water or clinging to the mat edge, this narrow zone borders the entire lake and is wet throughout the year. It will not hold the weight of a man.

SPHAGNUM-SEDGE MAT ZONE: This zone is bounded on lakeside by the border of sedges and on the upland side by the bog-shrub zone. The area is dominated by the non-clumped rush, *Rhynchospora alba* (beakrush) and *Vaccinium oxycoccos* (creeping cranberry). Both species are growing on a dense carpet of *Sphagnum* spp., which also supports the tiny sundew, *Drosera rotundifolia.* Western hemlock seedlings are abundant. Much of the substrate is a black muck, a mixture of sedge and limnic peats; the rest of the mat is composed of the raw brownish peat of sphagnum. This part of the mat is not grounded and is inundated by water or covered with ice in winter. Skunk cabbage appears in the wetter sites. Toward the bog-shrub edge of this zone, great clumps of the lichen, *Cladonia rangiferina,* intermingle with the sphagnum; these clumps extend into the next zone.

BOG-SHRUB-TREE ZONE: An abrupt boundary is formed by the bog shrubs, Labrador tea and bog laurel. Stunted western hemlock occurs on all parts of this zone but seems to be concentrated at the abrupt boundary of the mat zone. Some

[3]Rush is the common name for the family Juncaceae. Members of the family Cyperaceae are called sedges, a large genus of which is *Carex.* These two latter names are used interchangeably in the present article.

of these trees are 30 to 70 years old and only four to six feet tall. Sitka spruce and Douglas fir do occur on the bog but in rare numbers. The zone is characterized by the hummocky growth of sphagnum around the bases of the trees and shrubs. In the depressions one finds a few potholes where the water lily, *Nuphar polysepalum,* and skunk cabbage flourish.

MARGINAL DITCH ZONE: This zone refers to the vegetation growing around the ditch which never fills in between the peat bog and its contact with the mineral uplands. The ditch is not continuous around Kings Lake, but confined to its eastern side. Access to Kings Lake is through this zone. There are a few hemlocks and spruce, about which an impenetrable thicket six to eight feet high has formed. The thicket of shrubby plants includes: *Spiraea douglasii* (hardhack), *Lonicera involucrata* (black twinberry or bearberry honeysuckle), *Cornus stolonifera* var. *occidentalis* (red-osier dogwood), *Menziesia ferruginea* (fool's huckleberry), *Salix* spp. (willow), *Alnus rubra* (red alder) and *Rhamnus purshiana* (cascara). Skunk cabbage is the dominant herb. Sphagnum is not abundant. The substrate is a mixture of peat and black organic muck.

TRANSITION ZONE: The area supports both bog and forest species; it is the buffer zone between forest and bog except in the marginal ditch area. The trees are 20 to 50 feet tall and are mostly western hemlock, Douglas fir and western red cedar *(Thuja plicata).* Unusually vigorous plants of Labrador tea are intermingled with the blue huckleberry, *Vaccinium membranaceum.* These shrubs form a dense layer, under which skunk cabbage *(Lysichitum americanum)* and bracken fern *(Pteridium aquilinum)* grow. The ground is blanketed by the moss *Hylocomium splendens.* Less abundant mosses are *Sphagnum* spp. and *Calliergonella schreberi* occurring in the wetter and drier sites respectively. Sphagnum peat is found 10 to 16 inches below the rich black muck, indicating the slow advance of forest onto bog.

FOREST ZONE: The area surrounding Kings Lake supports a forest of western hemlock, western red cedar and Douglas fir. Deciduous trees are cottonwood *(Populus trichocarpa),* large-leaf maple *(Acer macrophyllum),* vine maple *(Acer circinatum)* and red alder. The ground cover is varied but commonly includes bracken fern, deer fern *(Blechnum spicant), Vaccinium* spp., sword fern *(Polystichum munitum),* salal *(Gaultheria shallon)* and twinflower *(Linnaea borealis).*

The north end of Kings Lake bog with stunted hemlocks in background. Photo: Nancy Walz

A phytosociological survey confirms the zonal differentiations observed on Kings Lake bog, and the data and detailed species lists are available in Fitzgerald (1966) for comparison and future analyses.

Conifer seedling counts confirmed that western hemlock was germinating abundantly in the sphagnum mat zone, but no seedlings of any conifer could be found in the mature bog zones. The marginal ditch supported a number of western red cedar seedlings.

Temperature studies

The field study at Kings Lake bog was designed primarily to measure the temperatures of the microclimate, i.e., the air temperature taken within 10 cm of the ground. The majority of plant processes, particularly those involved in seedling establishment, occur within the realm of the microclimate. Air temperatures of the macroclimate were measured at two meters above the ground (the standard height for U.S. Weather

Bureau records) for comparison. Since seedling survival interested me, temperatures of the substrate were taken within 4 cm of the surface. Figure 1 illustrates the placement of temperature measurement instruments on the bog and in the surrounding area.

The instruments were installed on June 15, 1964 after which thermograph records and maximum-minimum thermometers were reset every 10 days until November 27, 1964. At this time the bog became inaccessible because of flooding of roads and heavy snowfall. Recordings were resumed on February 5, 1965 and continued until the study terminated on November 7, 1965. Substrate temperatures were recorded with permanently placed thermocouples on four summer days in 1965. Information regarding the instruments and all the raw temperature data appear in Fitzgerald (1966).

Interpretation of temperature records

MAXIMA: Kings Lake bog has consistently higher maxima than the surrounding forest (Fig. 2). The lack of canopy over the bog accounts for the more extreme temperatures; canopy prevents excessive overheating of the microclimate during the day in the forest. Consequently, bog stations exhibit (on some days) maxima that are 35 degrees F higher than the maxima recorded in the forest microclimate. Figure 3 illustrates that air temperatures measured at 2 m (macroclimate) are not indicative of the conditions to which the plants are subjected.

MINIMA: Kings Lake bog exhibits colder nocturnal temperatures. During the growing season, frosts occur on all parts of the bog, while none occur in the forest (Fig. 2). A canopy prevents excessive loss of reradiated heat at night; hence the forest microclimatic temperatures remain above freezing, while bog and swamp temperatures drop as much as 11 degrees F lower on the same night.

BOG MICROCLIMATES: Each vegetation zone on the bog has its own microclimate. The mature parts of the bog exhibit more extreme temperatures than do the younger parts; for example, the lake edge has the mildest maxima and minima. These results were expected, for a large body of water moderates the potential temperature regime of its surrounding microclimate. The

Fig. 2. Microclimate degrees F and days on which they were obtained for stations at Kings Lake bog in 1965. Readings for other stations are available in Fitzgerald (1966).

MAXIMA					MINIMA				
Date	Lake Edge	Mid-Bog	Outer Bog	Forest	Date	Lake Edge	Mid-Bog	Outer Bog	Forest
2/17-21	66	60	60	50	2/6	0*	--	−3	--
3/4	71	74	68	52	2/11	24	23	21	31
3/10	70	75	68	58	2/28	22	16	17	30
3/30-31	72	76	74	59	3/18	13	8	6	22
4/8	65	72	69	54	3/24	17	10	15	27
4/15	68	71	72	73	4/11	24	20	21	32
4/27	84	100	91	--	4/22	26	22	23	33
5/8-10	81	79	85	62	5/2	28	24	23	33
5/27	92	85	88	--	5/15	26	20	22	34
6/2	92	93	89	58	5/27	30	25	26	32
6/7	87	93	94	62	6/6	38	32	28	33
6/22	79	86	90	54	6/14	33	30	30	31
7/1	88	98	98	66	6/25	32	28	26	30
7/13	86	94	93	63	7/8	38	32	40	34
8/1-2	98	105	105	70	7/22	40	33	32	36
8/7	88	95	94	65	8/4	43	36	37	38
8/18	92	99	94	--	8/18	40	32	33	38
9/7	79	86	80	63	9/4	34	28	28	--
9/23	76	80	79	60	9/15	34	28	33	42
9/24	78	84	80	61	9/24	34	26	28	35
11/7	80	85	83	62	11/7	30	28	28	32

*"--" indicates information not available either because equipment was not yet in place or was malfunctioning; "0" indicates no frosts had occurred by this date.

Left: *Drosera rotundifolia.* This minute insectivorous plant has a tall delicate inflorescence in mid-summer. Right: *Vaccinium oxycoccos,* a creeping vine with evergreen leaves and tiny Dodecatheon-like flowers.

Right: *Menyanthes trifoliata.* Relatively large flowers for a bog plant and lush trifoliate leaves. Photos: G. Pirzio-Biroli

Left: *Kalmia occidentalis.* A close-up of one flower and a developing capsule. This plant blooms several weeks before *Ledum groenlandicum,* pictured at right. Notice revolute leaf margins on both plants; the latter has also a heavy indumentum on the underside.

harshness of bog microclimates is illustrated by the following data comparing the range of temperature extremes (diurnal flux) during a 24-hour period on July 30, 1965 at three stations:

Inner bog:	44° to 98°	(range = 54°F)
Mid-bog:	38°to105°	(range = 67°F)
Forest:	45° to 70°	(range = 25°F)

FROST DANGER: Figure 4 dramatically illustrates that plants on bogs have a very short growing season. The microclimates of the mature bog (mid- and outer bog stations) have comparatively few frost-free days, while the microclimate near the lake edge is certainly more favorable to establish seedlings. The forest has the greater number of frost-free days. Even more important is when the frosts occur; the following table shows that summer frosts are a potential threat to plants trying to establish in the mid-bog area, which had 22 frosts in the summer of 1965.

SEASONAL DISTRIBUTION (# of days) OF FROSTS*

Station	Spring 3/21-6/21	Summer 6/21-9/21	Fall 9/21-12/21
Inner bog	21	6	41
Mid-bog	37	22	43
Forest	18	4	17

*Macroclimatic minima of 32° F or below

SUBSTRATE TEMPERATURES: The temperature of the substrate affects plants directly through physical contact and indirectly through its subtle influence upon the microclimate. The microclimatic extremes are often determined by the amount of heat absorbed, conducted and stored in the underlying substrate. These properties are delineated for various soils by Geiger (1965); peat ranks the lowest in heat conductivity and diffusivity. That means that all the sun's energy is not transferred to lower depths, but concentrated in the first few centimeters of the bog's surface.[4] Bog plants have to cope with a super-heated substrate and have to function in a hot microenvironment. Vaartaja (1949) found that heat lesions appear on young conifer seedlings when the topsoil temperatures approach 122°F. Death ensues because of desiccation or invasion of the wound by pathogens.

Substrate temperatures were measured at the bog on four different days. Only one instance was found where substrate temperature approached a critical point: 119°F at the mid-bog on August 11, 1964. Air temperature was 86°F; the microclimatic temperature was 94°F. Unfortunately, substrate temperatures were not recorded on the hottest days of summer. Extrapolation from air temperatures indicates that critical temperatures in the substrate could be expected. For example, on August 9, 1965 the microclimatic air temperature at mid-bog reached 113°F; the substrate temperatures surely reached the critical point for lesion formation.

In summary, a plant attempting to establish on a bog has to cope with the following conditions: high acidity, low oxygen, lack of nutrients, summer frosts (many below 28°F), threat of heat lesions because of excessive substrate temperatures, high microclimatic temperatures encouraging desiccation through rapid transpiration, low root temperatures retarding chemical exchange and metabolic processes.

Availability of conifer seed

Seed traps on the bog yielded a total of 90 seeds in 1965, a year reported by Weyerhaeuser

***Ledum* silhouetted against the lake. Photo: Nancy Walz**

[4]The change in temperature gradient from the peat surface to an eight-inch depth is 53° F measured at the inner bog station.

to be a very poor seed year for all species. Sixty-five seeds were western hemlock, six were Sitka spruce, and nineteen were western red cedar. There were no cone-bearing trees of Douglas fir within the optimum dispersal range of 200 feet.

Seed germination and survival on the bog

The significance of bog temperatures cannot be evaluated until observation of actual effects of these temperatures upon the germination of seed and survival of conifer seedlings is made. These observations were plagued by many unforeseen variables which limited the direct correlation of microclimates with seed and seedling performance.

The seed of five species were used in the field plantings: Sitka spruce, Douglas fir, western hemlock, lodgepole pine *(Pinus contorta)* and western white pine *(P. monticola)*. The pines were known to be invaders of other Pacific Northwest bogs. In October, 1964 four different microenvironments (forest, transition, mid-bog and sphagnum mat) were sown with 15,260 seeds. All of the plantings were protected from rodent predation by one-half inch mesh screens. However, I failed to think about insect predation. My sunken plastic pots were ideal traps for Carabid beetles. Once inside, they dined well on the conifer seed — all winter long.

Consequently, a second planting of 11,808 seeds was made on May 2, 1965. Two substrates were used at each of the four sites: 1:1 sand-peat mixture from the greenhouse and the natural substrate occurring at each site. One set at each site was open to predation; the other set was planted in wooden boxes enclosed by a fine mesh nylon screening. Surveys of all plantings were made on five different dates throughout the 1965 season. Numbers of live and dead seedlings were recorded and total percent germination and survival for all plantings was compiled; percent germination and survival was established by controls in the greenhouse. Figure 5 gives an idea of the relative numbers germinating and surviving at the four planting sites. The rest of the data appears in Fitzgerald (1966). Seed of all species germinated on the bog. The absence of such conifers as Douglas fir and the pines on Kings Lake bog cannot be explained by germination failure. The propagules are not reaching the bog. Germination percentages were as high in

	MAXIMA (°F)				MINIMA (°F)			
	June 2		July 22		June 6		Aug. 1	
STATION	M	m	M	m	M	m	M	m
Outer bog	77	89	95	105	37	28	40	32
Transition	78	84	94	95	39	40	41	42
Forest	74	58	89	70	43	33	46	36

*M = temperatures recorded 2 m above ground.
m = temperatures recorded within 10 cm of the ground.

Fig. 3. A comparison of macroclimate (M) and microclimate (m). *Records taken at three stations on different days in 1965.

	1964		1965	
Station	Late Frost	Early Frost	Late Frost	Early Frost
Lake edge (m)	-- *	10/3	6/22	9/28
Inner bog (m)	6/29	9/9	5/18	9/18
Mid-bog (m)	7/5	9/5	6/29	8/6
Outer bog (M)	0	10/3	5/18	9/18
Outer bog (m)	6/29	9/5	7/22	8/28–9/3
Transition (m)	0	10/12–11/2	5/18	9/28
Transition (M)	0	10/3	5/18	9/18
Forest (m)	--	11/14	6/22	0
Forest (M)	--	10/12–11/2	7/8	11/3
Swamp	--	10/3	6/22	9/18

*For explanation of "--" and "0" see footnote, Fig. 2; a series of dates (e.g. 10/12-11/12) indicates recordings were made at some undetermined time during that period.

Fig. 4. Number of frost-free days occurring at each temperature station in 1964 and 1965. (June 15, 1964-November 7, 1965). M = macroclimate; m = microclimate.

SPECIES	SOIL	Lake edge		Mid-bog		Trans-ition		Forest	
		G*	S	G	S	G	S	G	S
Douglas fir	N*	50	44	6	0	46	39	3	0
	S-P	26	18	5	0	40	40	5	0
lodge-pole pine	N	53	44	2	0	38	20	5	0
	S-P	27	26	51	0	85	69	10	0
hemlock	N	27	27	33	0	17	1	2	0
	S-P	5	3	14	0	64	58	13	5
spruce	N	49	38	3	0	56	55	0	0
	S-P	14	13	7	1	29	27	1	0

*G = total number of seeds germinated out of 100 planted
S = total number of survivors
N = natural substrate (soil)
S-P = sand-peat substrate (soil)

Fig. 5. Total number of seeds germinated by Nov. 7, 1965 compared to total number of survivors on that date for two different substrates. Seed planted May 2, 1965.

natural sphagnum as in sterilized sphagnum[5] (the sand-peat mixtures), indicating that low pH does not prevent germination of conifer seed. Survival of seedlings was high in both substrates in the greenhouse compared to a very low survival in the field. The sphagnum mat (lake edge) and transition zones encourage the highest germination and survival percentages; both zones exhibit milder microclimates. High mortality is seen in two zones: the mid-bog station, which had 22 summer frosts, and the forest, which had no summer frosts because of its dense canopy. Shade and mold account for much of the mortality in the forest zone.

Summary

Conifer invasion on to Kings Lake bog (of species other than western hemlock) is limited by the unavailability of a seed source. Seeds that reach the bog suffer heavy predation by beetles.

The bog has a more severe microclimate than the surrounding forest and has a much shorter growing season. The generally high germination and low survival figures indicate that selection operates on the establishing conifer seedlings, not upon their ungerminated seed. No seedlings remained alive in the most severe microclimate of the bog, i.e. the mature bog-shrub-tree zone. The majority of individuals survived at the lake edge, which has a comparatively mild microclimate and where the natural seedlings were found in greatest abundance. The microclimates of Kings Lake bog do not prevent establishment of conifers, but limit establishment to certain zones. Further study of conifer seedling establishment should clarify the role that microenvironment plays in maintaining the characteristic vegetation and unique aspect of a bog.

Epilogue

Some interesting generalizations concerning the mode of bog succession are generated by the Kings Lake study. The standard textbook description of bog succession may have to be modified to include a second center of invasion. Most invading species move onto the bog from the transition zone where the soil is more favorable, the temperature and light conditions are ideal and seed sources are close. A second, but weaker, front for invading species seems to be the floating sphagnum mat. As succession progresses, those established conifer seedlings manage to survive the quick invasion of the mat by the bog shrubs. As the bog-shrub zone matures, the microclimate becomes harsher, preventing seedling establishment and promoting self-maintenance for hundreds of years. The eventual encroachment of the transition zone alters microenvironmental conditions; bog vegetation slowly disappears; forest vegetation flourishes.

The final act in this long drama culminates with the death of the lake and birth of the forest, the bog having been the principal character. The role that microenvironment plays in the bog scene remains unanswered: is microenvironment directing, casting or simply designing costumes in the cosmopolitan drama of bog succession?

Acknowledgement

I thank Dr. Arthur R. Kruckeberg for introducing me to Kings Lake bog. He was a constant source of guidance throughout the investigation.

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[5]Sterilization raises pH from 3 to 5.5.

Garden Vignettes

The wine-red leaves caught the late afternoon sun from behind, turning them to bright crimson. They danced with a slight breeze, creating a spectacular flowing pattern of color. Two of these small trees stood 15 feet high with another one lower and more spreading. Under them in the foreground a profusely blooming azalea had grown to about three feet wide as well as high. Its large white flowers had a distinct blotch of deep carmine pink. The dark wine foliage of the small trees set off the stark white flowers, complementing their carmine centers.

What were these plants that created such a show?

The small trees were *Cotinus coggygria (Rhus cotinus)* cv. 'Royal Purple,' the purple smoke bush. This plant usually grows as a shrub, but in time it will become quite tall allowing one to look up into it. With a little help from the gardener as it is developing, it can be trained to have a single trunk. The leaves are broadly oval and about one-and-one-half inches long. The petioles, about an inch long, allow the leaves to move freely in the breeze. Veins, petioles and leaf margins are a lighter shade of red. The plant prefers rather poor soil and a dry location. Its common name comes from the inflorescence which appears in early summer; tiny flowers stand in upright panicles in a haze over the bush. Thus the name 'smoke bush.'

Completing the picture was *Rhododendron mucronatum (Azalea ledifolia)* var. *sekidera. A. l. alba* is well-known to most gardeners, but its varietal form, *sekidera,* is seen much less often. It differs from the former only in having a carmine blotch. In addition to their striking beauty, the flowers are also delightfully fragrant. Planted farther forward in the bed the azalea enjoys good friable soil and more water than the smoke bush.

With their separate requirements satisfied, they make a spectacular combination, and both plants have been growing happily together for many years.

BETTY GRAY

When we first moved to Mercer Island in 1954, we bought a home with an acre of ground and blackberry vines growing in a thick jungle up to the back door. In the process of removing them with much blood, sweat and sore muscles, we uncovered a poor, bent, emaciated rhododendron. We rescued it and planted it in a bed by the front door.

After it had bloomed, I checked the trusses at the rhododendron shows and it seemed to resemble *Rhododendron* 'Purple Lace.' The truss is reddish-purple and of medium size. It blooms in late May, and if the weather stays cool, the flowers will last a month.

In 1962 when we started to build our new house, we brought 'Purple Lace'(?) along and stuck it in a corner of the yard where the bulldozers wouldn't bother it. And there it has remained. Because it is so elderly — who knows how long it had been there under the blackberries? — it puts on very little new growth each year. However, it blooms heavily and reliably every spring. It is not an easy color to incorporate into a garden plan.

After moving *Rhododendron* 'Gold Mohur Yellow' around several times trying to make it happier we put it beside and a little in front of old 'Purple Lace'(?) and what a friendly combination that has been! They took to each other at once. They bloom at the same time, and the soft gold-apricot blooms against the magenta ones show up much better. 'Gold Mohur' is a Lester Brandt hybrid ('Daydream' × 'Margaret Dunn') and won an A.R.S. Preliminary Award in 1955.

Underneath them is a carpet of *Saxifraga umbrosa* (London pride) which blooms at the same time as the rhododendrons. It has beautifully

shiny rosettes of leaves, and the inflorescence is a delicate spray of dainty blossoms on an eight- to ten-inch stem. These are excellent in bouquets, used in much the same way as *Gypsophila* (baby's-breath), which flowers much later.

This pair of rhododendrons represents one of the happy accidents that occur in every garden.

JODY LOGAN

Foliage color and contrasting textures are often more important in the landscape than the ephemeral flowers upon which our spring and summer gardens rely. Last winter, and especially on dreary mornings, I often glanced with pleasure at a small planting 30 feet from the house. The area is less than four feet square, and no plant in it exceeds a foot in height.

Against a low madrona stump, long since covered with moss, sprawls a *Hebe* × 'Carl Teschner.' In winter it assumes a purplish cast, for the stems are, indeed, purple, and the margins of its tiny dark green leathery leaves take on similar hues. The wet moss is a brilliant green as are the even smaller leaves of another, more compact *Hebe* in the foreground. All of these are merely a foil for the glowing burgundy of a *Leucothoe keiskii* nearby. Its glossy, ovate-lanceolate leaves with long-acuminate apices are elegantly disposed on slender arching branches.

In summer the effect changes completely. The *Leucothoe's* leaves revert to a light olive green; its flowers, though relatively large, hang below the leaf axils where they are unnoticeable from a distance; the moss dries and becomes inconspicuous. Over a period of several weeks, however, the *Hebe* 'Carl Teschner' presents a lavish display of delicate lavender flowers, a reminder of the more somber purple of its winter leaves.

This is, no doubt, a temporary planting. Ultimately the *Hebe* will overgrow the stump, obscuring the moss, unless it is ruthlessly pruned or severely cut back by one of our colder winters. The *Leucothoe* may become too large to remain in scale with its companions. But for the present, and for the next several years, I shall depend on this small picture to brighten the winter days.

JAN PIRZIO-BIROLI

In February — *Rhododendron* 'Olive' with a very dark *Helleborus orientalis,* heather 'Vivelli,'* a lilac early species crocus — 'Vernus Vangard' or 'Barr's Purple' — and white crocus 'Snowbunting.' All seen from my kitchen window no matter how awful the weather.

JANE ROGERS

The vignettes presented above represent the creative talents of four different gardeners, described each in her own way. Perhaps they have given you a new insight into garden design.

Each of you has a favorite corner in your garden. Won't you share with us?

THE EDITOR

*In the new Arboretum catalog this is *Erica herbacea (E. carnea)* cv. 'Vivellii.'

WEATHER IN THE ARBORETUM — June 1976 to May 1977

	Precipitation		Temperature*			
			High		Low	
	mm.	in.	C°	F°	C°	F°
Jun	26.9	(1.06)	30.0	(86)	3.3	(38)
Jul	21.3	(0.84)	29.5	(85)	6.1	(43)
Aug	79.0	(3.11)	26.7	(80)	7.8	(46)
Sept	36.1	(1.42)	29.4	(85)	6.1	(43)
Oct	46.5	(1.83)	21.7	(71)	1.1	(34)
Nov	15.5	(0.61)	17.8	(64)	−3.9	(25)
Dec	49.5	(1.95)	15.0	(59)	−1.7	(29)
Jan	56.9	(2.24)	13.3	(56)	−5.6	(22)
Feb	41.1	(1.62)	17.2	(63)	−1.7	(29)
Mar	118.2	(4.65)	16.1	(61)	0.0	(32)
Apr	34.6	(1.36)	25.0	(77)	2.2	(36)
May	105.6	(4.16)	27.2	(81)	3.9	(39)
Total	631.2	(24.85)				

*Days with max. below 0°C. (32°F.) 0
Days with min. below 0°C. (32°F.) 40

Stalking Ornamental Plants In China*

MARK RAVENHOLT

The peeling bark of *Acer griseum*. Photo: Nancy Walz

Ernest Wilson (1876-1933)

James Veitch of the famous nursery firm, Veitch and Sons, told Ernest Wilson on the eve of his first expedition to China in 1899, "My boy, stick to the one thing you are after [*Davidia involucrata*] and do not spend time and money wandering about. Probably almost every worthwhile plant in China has now been introduced into Europe." (Cox, 1945.) The results of many expeditions over the next 20 years by Wilson and others proved the ignorance of that statement a thousandfold.

Wilson was trained, beginning at an early age, first at the Birmingham Botanic Garden, then at Kew. He won the Queen's Prize for Botany and was just about to take on a teaching post when Veitch commissioned him as a collector to travel to China in order to bring back the dove tree which David had found but never introduced. On his way to the Orient Wilson stopped at the Arnold Arboretum in Boston and made the propitious friendship of its director, Charles Sprague Sargent.

At the time of Wilson's first expedition, China was involved in the Boxer Rebellion — a fanatical movement fueled by volatile anti-foreigner sentiment. The center of the rebellion was around Peking, but, operating out of a houseboat on the Yangtze River based at Ichang in Hupeh Province, Wilson was able to enjoy a comparatively peaceful political climate. He managed to train some native Chinese to assist with his collecting which, no doubt, contributed to his success.

When Wilson arrived, full of anticipation, at the site where a dove tree had been reported years earlier he found only a stump and learned the tree had been chopped down to make a house. Luckily, a thorough search of the area produced 20 more of the trees in full flower. Wilson collected a quantity of ripe seed which proved invaluable, for in his almost 20 further years of explorations he never again came across the tree bearing ripe seed.

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*This is the second of a two-part article which began in the preceding issue of the *Bulletin* (Vol. 40, No. 2, p. 27).

On his first trip he had concentrated on the province of Hupeh. In 1902 Veitch again sent him out, this time to Szechwan. Evidently the success of the first trip in addition to finding the dove tree (i.e. more than 300 species including *Actinidia chinensis, Acer griseum, A. davidii, Clematis armandii, C. montana rubens* and *Viburnum rhytidophyllum*) had convinced the Veitch firm that China's ornamental plant cupboards had not yet yielded all their gifts. The specific goal of the second expedition was to find and introduce *Meconopsis integrifolia* and other hardy herbaceous plants.

In 1906 Professor Sargent arranged for Harvard University and a group of private subscribers to finance Wilson's third expedition with the goal of finding new ligneous ornamental flora. *Magnolia wilsonii, Lonicera nitida, Rhododendron augustinii* and *Hydrangea aspera* subsp. *sargentiana* were all introductions from this trip.

He again set out for China in 1910, this time primarily to search for the regal lily *(Lilium regale)*. He found it in the Min River gorges of western Szechwan north of Cheng-tu, but trouble struck on his return trip. ". . . an avalanche of mud and shale swept them off the track and down the hillside; and then, while he was struggling to get out of his sedan chair, one last boulder broke Wilson's leg in two places. His men got him back to the path and set about improvising a splint from one of the legs of his camera tripod, but while they were doing so a mule train came up. There was no room for it to pass, it could not stop on the still crumbling track, and there was nothing for it but to lie down and keep still while fifty animals one after another stepped over Wilson's body; and not a hoof touched him. By the time they reached Cheng-tu the leg was infected, and it was another three months before Wilson could leave on crutches for the long homeward voyage to America, where the bone was broken again and reset in a Boston hospital. He walked with a limp for the rest of his life, but the lily bulbs arrived safely and it is said to have been from this consignment that all of our stocks of *Lilium regale* are descended today." (Healey, 1975.)

Wilson was a prolific writer and an excellent photographer. He made other trips to Japan, Korea and Taiwan but no more to China. With the death of Professor Sargent in 1927, Wilson was appointed Keeper of the Arnold Arboretum. Three years later he and his wife were killed in an automobile accident in Massachusetts.

***Clematis montana* var. *rubens*. Photo: Nancy Walz**

George Forrest (1873-1932)

Born at Falkirk, Scotland in 1873, George Forrest was educated at Kilmarnock Academy and then employed in a chemist's shop where part of his training included making a herbarium-type collection of plants.

A small legacy allowed Forrest to travel to Australia where gold fever gripped him temporarily and where he later became a sheep rancher. His years in Australia had toughened him both mentally and physically so that in his late twenties we find Forrest, "a short, sturdy, deep chested man, who preferred to clothe himself in country garb rather than in that of the city and who wore the air of knowing what he was going to do and the quiet confidence of doing it, stamped on his face and bearing." (Cooper, 1935.)

Upon Forrest's return from Australia in 1902 Professor Bayley Balfour, the Regius Keeper of the Royal Botanic Garden in Edinburgh, offered him a "meagre post in the herbarium." Forrest accepted and applied himself to the study of gen-

eral botany and, especially, herbarium specimens from around the world.

In 1904 Prof. Balfour recommended him as a collector to A.K. Bulley, a wealthy Liverpool cottonbroker who was designing an ornamental garden which he fancied full of exotic and rare Chinese plants. Supported almost exclusively by Bulley, Forrest set out on the first of seven expeditions to China that spanned 28 years. Only the first was financed by Bulley. The second and third were funded by syndicates of prominent British horticulturists and the last four by the new Rhododendron Society formed in 1915.

Like Wilson, Forrest trained natives to help him collect plants but he did a more thorough job of it and trusted them to scour whole areas independently thus covering large amounts of territory very quickly. By the time of his third trip he had a staff of 20 well-trained assistants mostly from the Mosso village U-lu-kaey in the Lichiang mountain range.

In the summer of 1905 Forrest visited the French Catholic mission station at Tzekou on the Mekong River in northwest Yunnan. This region was in an extremely agitated state because of hostilities between the Chinese and the Tibetan Lamas.

One night Forrest with two missionaries and a group of native Christians attempted a desperate 30-mile march to the town of Yetche where there was a garrison of Chinese soldiers. Their party was detected as they passed a Lamaserie. In the ensuing attack, Forrest was separated from the others.

After nine days of struggling through the jungle he stumbled on some friendly Tibetans who fed and hid him for four days and then led him up the precipitous Mekong-Salween divide, "Up and up we climbed, struggling through canebrakes, cutting our way through miles of Rhododendrons, tramping over alps literally clothed with Primulas, Gentians, Saxifrages, Lilies, etc., for these unknown hillsides are a veritable botanist's paradise." (Cooper, 1935.) At 18,000 feet they traveled along a snow and ice ridge for six days, then descended into friendly territory.

Since Forrest kept no diaries or journals, wrote no books and few articles it is hard to trace his routes. It is known, however, that he covered much of the area between 29 and 24 degrees north latitude and between 98 and 102 degrees east longitude. His favorite area was the Rhododendron-rich region where the high Lichiang mountains divert the course of the Yangtze River into the form of a great loop. E.H.M. Cox describes it as follows: "Since this is typical of a Yunnan hunting ground at its best, we can discuss the various levels with slightly more detail. From 7000 feet to 10,000 feet, there is a belt of trees and shrubs, full of fine hardwoods, the lower-level Rhododendrons and such shrubs as Buddleia, Berberis, Deutzia, Gaultheria and Vaccinium. Next comes the Conifer belt from 10,000 to 11,500 feet. Here are found in the ascending scale *Pinus Armandii, Tsuga yunnanensis, Abies Delavayi* and *Larix tibetica*. In the open glades are Incarvillea, Anemone, Aconitum, Cypripeduim, Delphinium, and a number of Lilies.

"Some sections of the eastern flank of the range have been worn away to a series of graduated cliffs. On these ledges grow such plants as *Primula Forrestii* and *Dracocephalum bullatum*. Above the Conifer belt are moister meadows, the home of *Primula Littoniana* and *Meconopsis integrifolia*.

"George Forrest always said that the cream of the flora was in the alpine pastures and on the enormous screes that lie from 12,000 feet to the limit of vegetation. Compositae of all kinds, Gentians, Primulas such as *P. sonchifolia, P. secundiflora* and *P. calliantha,* dwarf Rhododendrons such as *R. Sargentianum, R. intricatum* and *R. prostratum*. The last grows at the highest altitude, over 16,000 feet."

Interestingly enough the Lichiang range and the adjacent Salween-Mekong and Mekong-Yangtze divides, where normally calcifuge ericaceous plants grow so abundantly, are composed mainly of magnesian limestone. In a paper delivered to the Royal Horticultural Society, Forrest said, "Recently there has been much discussion regarding lime and ericaceous plants, especially as applied to the cultivation of Rhododendrons. As already mentioned, most, if not all, of the mountain ranges of W. and N.W. Yunnan are solely limestone formations, and it is on those the greater number of the Rhododendrons are found. I am not in a position to give a decided opinion, but this I can state positively, that most of the Rhododendrons I have collected in that region grow directly in, or on, pure limestone." (Cox, 1945.)

From an area of the Lichiang range which Forrest first visited in 1910 comes an interesting

horticultural anecdote. He remembered this area as, "densely clothed in forests of Larch, Pine and Abies, with an undergrowth of dwarf, 1-2 feet, evergreen spinous-leaved Oak, and straggly, drawn-up specimens of such Rhododendrons as *Fortunei, racemosum, praecox* and *lepidotum.*" When Forrest returned three years later he found that the area had burned over. "What I wish to point out," he continued, "is the marvellous hardiness of the Rhododendrons to withstand such a fire when the heavier timber succumbed, and also the remarkably symmetrical growth of each of the species since the time of the fire. On an average the shrubs are 2½-3 feet high, by about as many or more in diameter, and I don't think I have witnessed such a fine sight as the mass of bloom borne by each individual plant, the size and purity of those blooms, and the extremely artificial aspect of the whole scene caused by the regular spacing of the plants. The whole scene gave one the impression as of having been laid out by an expert landscape gardener, as indeed it had by nature." (Cox, 1945.)

Because of his efficient use of native collectors, Forrest's contributions were prodigious. Some of his more important introductions were: *Abies forrestii, Acer davidii, A. forrestii, Aster forrestii, Delphinium likiangense, Gaultheria forrestii, Gentiana sino-ornata, Incarvillea delavayi, Pieris forrestii, Primula beesiana, P. forrestii, P. nutans, P. chionantha, Rhododendron arizelum, R. cyclium, R. didymum, R. fulvum, R. giganteum, R. lacteum, R. muliense, R. valentinianum, R. repens* and *R. scintillans.* In 1932 while returning from his seventh expedition with two mule-loads of bulbs and seeds, Forrest died of heart failure.

Reginald Farrer (1880-1920)

". . . the heart of Asia is a strange and haunted land, playing very strange tunes on nervous systems bred for so many thousand years in the different atmospheres of the West. China, sooner or later, bends the solitary European inexorably but placidly to her mysterious will . . ." (Farrer, 1917.) It was with passages like this that Reginald Farrer managed to capture the romantic imagination of the gardening public of Europe and America and generate renewed interest in new plant introductions from China and its neighbors. Farrer had published a note on *Arenaria angelica* in the *Journal of Botany* at age 14 and was consumed by botanical curiosity for the rest of his life. After studying at Oxford and a journey to Japan, he spent several years tramping through the European Alps. Farrer completed his first book in 1913, *The English Rock Garden.* His obsession with alpine gardening may explain his preoccupation with high alpine areas in China.

During Farrer's first journey to China in 1914 he followed the border of Szechwan from Tibet into Kansu. He was accompanied by William Purdom, a lesser known but equally capable botanist. Since there was considerable intertribal warfare in much of the area they covered, they were forced to travel too quickly to conduct careful botanical explorations. Even so, this trip produced the wild tree peony, *Paeonia suffruticosa, Viburnum farreri (V. fragrans)* and the sweet-scented edelweiss, *Leontopodium haplophylloides.*

Farrer returned to Britain soon after World War I began. While working for the Ministry of Information during the war he found time to write two of his most famous books, *On the Eaves of the World* and *The Rainbow Bridge,* both concerning his travels in China and Tibet. After the war Farrer set out again for China, this time accompanied by E.H.M. Cox who would later write the textbook of plant hunting in China. This trip covered the dripping highlands of north Burma and would be outside our scope except for the fact that here Farrer died, probably of pneumonia, in 1920. Cox reminisces, ". . . I have a vivid memory of Farrer in the hills, his stocky figure clad in khaki shorts and shirt, tieless and collarless, a faded topee on his head, old boots, and stockings that gradually slipped down and clung about his ankles as the day wore on. The bustle of the early start; the constant use of the field-glasses which always hung around his neck; the discussions, very one-sided owing to my ignorance, about the value and relationship of the various plants; his intense satisfaction when a plant was once in the collecting tin and was found worthy; his grunt of disapproval when it was worthless; the luncheon interval with its cold goat rissole and slab chocolate; his enjoyment of our evening tot of rum, a necessity in the rains; and, above all, his indomitable energy that never spared a frame which was hardly built for long days of searching and climbing. All these, I say, are as fresh to me as if they had happened yesterday."

Photo: E.F. Marten

Rhododendron wardii **blooming in the Arboretum in late May.**

Frank Kingdon-Ward (1885-1958)

No plant explorer spent as much time hunting in China, Tibet and Burma as Frank Kingdon-Ward. The son of Harry Marshall Ward, F.R.S., Professor of Botany at the University of Cambridge, Kingdon-Ward attended Christ's College, Cambridge and in 1907 travelled to Shanghai where he was a schoolmaster for several years. A.K. Bulley, the wealthy cottonbroker who had financed George Forrest's first expedition, was now owner of the Liverpool nursery firm Bees Ltd. He hired Kingdon-Ward to collect in northwest Yunnan thus initiating a career that spanned some 28 years.

Kingdon-Ward covered immense territories; principally the headwater areas of the Mekong and Salween rivers, Yunnan, Burma, Assam, French Indochina (Laos and North Vietnam) and large parts of Tibet especially the Tsangpo gorges that lead to Assam in northwest India where the river name changes to Brahmaputra.

That plants native to this area are suitable for ornamental gardens in Europe and America is convincingly demonstrated by a successful case of reverse introduction. Kingdon-Ward discovered in Tibet, ". . . a village where the monastery courtyard was ablaze with flowers like an English cottage garden; hollyhocks, asters, dahlias, pansies, stocks, and nasturtiums. The local governor had been on a trip to Calcutta and brought back with him a box of Messrs. Suttons' seeds. They were to find that this was by no means unusual; many of the Tibetans were enthusiastic gardeners and American and English flowers were much in demand, especially at the monasteries. By now some of these might even have escaped from the gardens and established themselves in the hills side by side with native plants." (Kingdon-Ward, 1926.)

Although he covered vast territories, Kingdon-Ward's list of plant introductions is not as impressive as those of earlier explorers. He often collected in well-explored hunting grounds and insisted on doing all the collecting himself; in addition many of his areas were not as well-endowed with suitable ornamentals as, for example, Forrest's Lichiang range. However, some of his better known introductions are: *Acer wardii, Cotoneaster wardii, C. conspicua, Gaultheria wardii, Lilium wardii, Meconopsis betonicifolia, M. violacea, Primula chungensis* and *Rhododendron wardii.* If the number of Kingdon-Ward's plant introductions falls short in comparison with those of other collectors, his prolific contributions to horticultural literature more than compensate for this deficiency.

Joseph Rock (1884-1962)

In the early twentieth century leprosy was rampant in many warm humid climates. The only known treatment was Chaulmoogra oil, a remedy known as long ago as 2500 B.C. but whose source was a mystery until Joseph Rock's search for it ended successfully.

Born in Vienna in 1884, Rock showed unusual aptitude for learning foreign languages; at the age of 16 he taught Arabic at the University of Vienna. In 1907 he was appointed professor of botany and Chinese at the University of Hawaii. His career in Hawaii impressed Dr. David Fairchild of the U.S. Department of Agriculture's Division of Foreign Seed and Plant Introduction to such an extent that he decided Rock was the man to search out the source of Chaulmoogra oil. In 1920 Rock found that two species of *Hydnocarpus* in the family Flacourtiaceae were the source of this rare substance and that these trees grow in Burma and Thailand. Chaulmoogra oil has since been replaced by sulfoxone sodium in the treatment of most leprosy cases.

After solving the Chaulmoogra riddle, Rock moved on to Yunnan in China where his presence was resented by George Forrest who considered much of the province his personal preserve.

Rock returned to the United States in 1924 but was soon on his way back to China under the auspices of the Arnold Arboretum and the Harvard Museum of Comparative Zoology. On this trip his objective was the massive and unexplored Amne Machin range between Szechwan and Tsinghai which has peaks as high as 25,000 feet. Although most of this area either lies under snow and ice or is a barren desert, the southwest portion of the range arrests the last puffs of moisture from the monsoons. Of this area in northwest Szechwan known as Tebbu-land, Rock wrote in 1926 ". . . in the Tebbu country we found various Hydrangeas, Viburnums, many Acer, some huge trees, huge Quercus, enormous Malus, Sorbus, even Meliosma, a few Koelreuteria with large compound leaves, a species of Padus, a tree 60 feet tall with trunks 2 feet in diameter, glabrous glaucous leaves . . . There are large panicle-bearing Aralias, beautiful Syringas in the drier regions, Ribes, Deutzia, Philadelphus, Caragana, Betula we observed four distinct species, Tilia, Cotoneaster, Juniper, Euonymus, Prunus, Lonicera, among them a tree 15-20 feet tall, with shaggy papery bark of a pale flesh colour, Jasmine, Crataegus, not the *C. pinnatifida,* Xanthoxylum, Rhododendron different from what we sent before, Populus, Salix, Rosa, Rubus, Berberis and last but not least the Abies and Picea." (Cox, 1945.)

For the next 15 years Rock threw himself into intense study of the Nakhi tribe of Lichiang, "Like an intelligence agent, he set out to crack the ancient pictographic code, something no other westerner had tried. Chinese scholars had toyed with translations with only partial success. Rock with his passion for detail eventually produced a bulky dictionary which not only translated but analyzed each Nakhi symbol historically, mythologically and linguistically." (Sutton, 1974.)

During his last plant exploration in China, sponsored by the American Rhododendron Society in 1948-49, he returned to his adopted home in Lichiang, "where life is not governed by the ticking of the clock but by the movement of celestial bodies." From this expedition he sent back seeds of almost 200 species, many of which have proved to be exceptionally fine forms of well-known Rhododendrons.

For the next 13 years Rock searched for a new home, first in Kalimpong, India, then Europe, followed by Seattle and finally Hawaii. In the early 1950's the University of Washington's Far Eastern and Russian Institute purchased Rock's library for $25,000 and appointed him as a permanent Honorary Research Associate.

Kingdon-Ward and Rock were the last major collectors in China before the Chinese Communists closed off the country in 1949. Though most of this parade of collectors have long since left us, the fruits of their labor shall enhance our living atmosphere for many generations to come. The treasures contained in the Arboretum are a remarkable testimonial to their success.

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Book Reviews

TREES AND SHRUBS HARDY IN THE BRITISH ISLES, Vol. III, N-R (Eighth Edition, Revised); Chief Editor, D.L. Clarke; General Editor, Sir George Taylor. John Murray Ltd., in collaboration with the Royal Horticultural Society, London, 1976. Price 17.50 pounds.

This important third volume in the new edition of a classic reference work has been long awaited. Its format follows the same pattern as that of its two predecessors. Genera and species are arranged alphabetically, with hybrids and cultivars placed under the species to which they are more nearly related. The length of description devoted to each depends largely upon its horticultural importance, its rarity or otherwise and its past history. The authors and their collaborators at Kew and elsewhere have a remarkable skill at discovering unusual facts relating to many of their subjects, no doubt because of the excellent facilities available to them in the herbarium and library there.

This volume, however, is considerably larger than Volumes I or II, having no less than 989 pages within its covers and weighing well over three pounds. Volume I ran to 845 pages, covering genera whose names began with the letters 'A' through 'C' only. Volume II dealt with 'D' through 'M' in 784 pages.

The reason for this great increase in bulk is the extensive treatment of the genus *Rhododendron,* where, for the first time, the hybrids have been included with descriptions provided for many of them, from the oldest still in cultivation to some of the most recent introductions. This expansion is one of the most valuable features of the work, even though it delayed its publication by a year or more. It will be invaluable for growers of these popular shrubs. Much of the data has been derived from careful descriptions made by the late Arthur J. Ivens, foreman at the Hillier Nursery, Winchester, England; other information has come from the files of the *Gardeners' Chronicle* since 1841 and the two volumes entitled *Rhododendrons and the Various Hybrids* by J.G. Millais, published in London, 1917 and 1924.

Rhododendrons, including azaleas both deciduous and evergreen, occupy 403 pages, or about 41 percent of the book, a good indication of their importance in modern gardens. Out of the 110 black-and-white photographs reproduced from many sources, 44 are of rhododendrons, of which 10 were taken in the wild in Bhutan and elsewhere. Although the majority of the illustrations in this volume are half-page or smaller, there are 17 handsome full-page plates.

Rhododendrons also have a separate table of contents and a bibliography arranged under several headings. There is an article on their propagation by F.P. Knight, formerly Director of the Royal Horticultural Society's Garden at Wisley, and very interesting histories by Donald Waterer of the famous Waterer and the Standish and Noble nurseries in Surrey; the former was begun in the late 18th century and continues to the present time.

Apart from *Rhododendron,* this volume includes the pines *(Pinus)* and spruces *(Picea),* cherries *(Prunus),* shrubby peonies *(Paeonia), Pieris* and *Potentilla* (which are given considerable attention with details to help distinguish these much confused small shrubs). In addition four important genera of trees are covered, namely *Nothofagus, Populus, Platanus* and the oaks, *Quercus.* The chief editor has personal knowledge of the *Nothofagus* in their Chilean habitat. The question of the origin of the London plane *(Platanus × acerifolia)* and other forms or hybrids of the genus is fully discussed. In view of the general importance and great variety in size, habit and leaf form of the oaks, 67 pages of text are devoted to them as well as 15 illustrations.

The 84 drawings scattered throughout the book are the work of Miss E. Goldring and Miss M. Grierson. Most of them depict flowering specimens and represent a wide selection of plants. Note that the full-page illustration (No. 43) is not of our native *Populus trichocarpa* but of the much rarer Chinese species, *P. lasiocarpa.*

Several changes in familiar names will be found, notably the two native eastern North American azaleas *Rhododendron roseum* (now *R. prinophyllum*) and *R. nudiflorum* (now *R. periclymenoides). R. metternichii* becomes *R. degronianum* var. *heptamerum,* while *R. yakushimanum* is retained as a species. Our native *Pachistima myrsinites* has been changed to *Paxistima myrtifolia,* having been first described as a species of *Myginda* under the latter specific name. Nevertheless, since they have been in common use for so long, it will probably be a considerable time before some of these nomenclatural changes are generally adopted, except in strict botanical circles.

It is certain that this volume is, like its two predecessors, an invaluable work of reference and information for any institution or person closely concerned with the woody plants with which it deals, especially in the case of rhododendrons. Since it is likely to remain so for a long time, it would be well to acquire a copy while it is still available.

BRIAN O. MULLIGAN

Publications Chairman, Mrs. Harry Slater, wishes to call attention to the following items. Foundation members receive a 10 percent discount on all books purchased through this committee. Call Mrs. Slater at 232-0456.

COMPLETE GUIDE TO PLANTS & FLOWERS, edited by Frances Perry. A Fireside Book published by Simon & Schuster, New York, 1974. 4½ × 7½ paperback. Price $6.95.

A book of more than 500 pages, the arrangement features photographs of two plants on one page with descriptive text on the opposing page. Information includes common name of plant, botanical name, place of origin, description, use, remarks, plus a picture key for sunlight, water, blooming season and hardiness zone. Within 17 miscellaneous groups the plants are arranged alphabetically by botanical name. Illustrated glossary and index.

PLANTS THAT REALLY BLOOM INDOORS, by George and Virginie Elbert. A Fireside Book published by Simon & Schuster, 1974. 6½ × 9 paperback. Price $3.95.

Much information plus interesting reading. 222 pp., illustrated with small black and white drawings.

Seventh Annual Fall Bulb Sale

October 5th & 6th 10 a.m. to 4 p.m.

Jeanne Gardiner in the Unit Council bulb bed. The flowers she holds are bulb ranunculus which winter over successfully in our climate. Photo: Jean Henderson.

The new format for the seventh annual Arboretum Foundation Fall Bulb Sale divides the sale into three phases: pre-order, public sale, and Unit meeting sales.

This year, only the pre-planted native bulbs and wildflowers from the east and west coasts may be ordered from a list sent out in August. (There will be no pre-orders of Dutch bulbs.) Pick-up of the pre-orders and sale of additional pre-planted items have been included with the sale of Dutch bulbs in the public bulb sale.

***Anemone coronaria,* de Caen mixture, not to be confused with the ranunculi pictured above. Photo: Nancy Walz**

The public sale will be held in the Arboretum office parking lot on Wednesday and Thursday, October 5th and 6th from 10 a.m. to 4 p.m. A catalog of Dutch bulbs, mailed in early September, will inform buyers of the choice available at the public sale.

The Bulb Committee has always purchased the more unusual bulbs not readily available in the typical nursery or supermarket. You will find dwarf species crocus, bulb iris, colorful alliums for winter drying, species rock garden narcissus and tulips, and many other choice bulbs. The "natives" for sale range from 18 varieties of trilliums to rare terrestrial orchids, and from fall blooming crocus to fragrant lilies. Jeanne Gardiner (Mrs. Arthur P.) is in charge of the pre-planted bulbs and Jane Rogers (Mrs. N. Stewart) of the Dutch bulbs.

A class of 15 Foundation members has been trained in bulb culture and will be available to visit Unit meetings in October or November. The Units may choose to have a half-hour selling period in addition to their regular program, or they may wish to have a complete bulb culture program which includes the sale of bulbs. Please contact Jeanne Gardiner, Bulb Chairman, 822-9704, or Jane Rogers, 232-7207, for a date.

Announcements From the Unit Council

Unit Council meetings are scheduled for September 15th, November 17th, March 16th and May 18th at St. Stephen's Episcopal Church in Laurelhurst from 9:30 to 12:00. At the September meeting, Mr. Peter Harvard from the firm of Jones & Jones will present a program showing past history and discussing potential development of the Washington Park Arboretum.

Glen Hunt, well-known landscape architect, past International President of the American Institute of Landscape Architects, will teach a seven-week course in Garden Architecture on Wednesday mornings from 10 to 12, beginning October 5th and running through November 16th. The class will be limited to 25 people and will cost $20. You may register by calling the Foundation office at 325-4510.

The Thorgrimson Cup was awarded this year to Unit 24, the Edith Banghart Unit, for outstanding service to the Arboretum. For 13 years this unit has mounted and labeled slides used by the Arboretum slide program. This year the group mounted more than 200 slides for Mr. Witt. Unit 24 made a $50 donation to the Patricia Calvert Greenhouse. In addition, its members have been active on the Unit Council Governing Board as chairmen of Work and Fun Day, the Slide Program and the Arboretum Explorers; they have served as department heads for the Plant Sale and have been active in nearly all areas of Arboretum activity.

RUTH MARY CLOSE

Unit Council Governing Board, 1977-1978

Officers — General Chairman, Mrs. Daniel H. Coleman (Sally Sue). 1st Vice-Chairman, Membership, Mrs. Stephen Bannick (Jeannine); Assistant, Mrs. Raymond Taggart (Doris). 2nd Vice-Chairman, Education, Mrs. Robert K. Arnold (Joan). 3rd Vice-Chairman, Greenhouse, Mrs. Frank L. Anderson (Chris); Assistant, Mrs. John B. McDiarmid (Mary). Secretary, Mrs. William E. Williams (Ruby); Assistant, Mrs. John L. Halloran (Darcy). Finance, Mrs. C. Edward Simons (Carol).

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CALENDAR OF EVENTS

Arboretum Foundation:	
Board of Directors	September 8
Executive Committee	October 13
	November 10
Unit Council:	
Unit Council Meetings	September 15
	November 17
Governing Board	September 8
	October 6
	November 3

For Information, Call 325-4510

Regularly Scheduled:	
Greenhouse Day	Every Tuesday
The Mae Granston Rhododendron Study Group	1st Monday
Herbarium Committee	1st Friday
The May Guy Northwest Natives Study Group	3rd Monday
Rock Garden Study Group	3rd Wednesday
Special Study Group	4th Monday
Arboretum Explorers	4th Wednesday (except December)

Annual Fall Bulb Sale: October 4 & 5

Work and Fun Day: April 13 Arboretum Foundation Plant Sale: May 3 & 4

Northwest Ornamental Horticultural Society Plant Sale: Sept. 21 & 22

New Union Bay Teaching & Research Arboretum

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New Members of the Arboretum Foundation

We are pleased to welcome the following new members (April 16, 1977 through June 15, 1977):

Sponsor — Mr. J. Scott Pratt, III. *Sustaining* — *Mrs. Mary T. Adams, *Miss Rose Mary Bacina, Chevy Chase Garden Club, Mrs. Allen F. Clark, Jr., Mrs. Donald E. Ehrlich, Ms. S.B. English, Mr. and Mrs. Donald Epstein, *Barbara Hewitt, *Ms. Mary Bess Johnson, Mrs. Susan Kemper, *Neal Komedal, Mrs. Barbara Kottsick, *Pamela McClaran, *Mrs. A.J. McCourt, Mrs. Dean L. McPhaden, *Mrs. Harry E. Morgan, Jr., *Mrs. Sharon W. Novark, *Mr. V. Dean Powell, *Mr. Harvy Sadis, *Mrs. Shawna L. Ward. *Annual* — *Mrs. Gerd E. Bjorseth, Mrs. Richard W. Bowden, *Miss Kathleen Callison, Mrs. Roy A. Carlstrom, Mrs. George Clarke, *Isaac Davis, Jr., Mrs. Louis A. Driggers, Mrs. Marie Drinkwine, *Dr. and Mrs. Leland R. Ellis, Mrs. Jack L. Fisher, *Mrs. Gwen Galeotti, Ms. Christine Giannini, *Sharon Goedecke, Mrs. Karen Graves, Mrs. Peggy Gurtel, Miss Trish Hanson, Mrs. W.R. Harrigan, Mrs. Diana Haslund, Mr. Fred M. Hopkins, Carol L. Kittell, Mrs. James F. Lane, *Penny Martin, Mrs. Douglas W. McCallum, *Mrs. Nancy McGrew, Mrs. W.W. McKenzie, Col. and Mrs. E. Scott Minnich, *Shelley Minor, Mrs. James R. Neely, Mrs. Cheri Nelson, Mr. and Mrs. David Niven, Mrs. Cheri Penttila, *Mrs. F.J. Pieters, *Mrs. Earl Rees, Mrs. Marillyn T. Reynolds, Mrs. Fred Richard, Mrs. John Berry Rodda, *Mrs. Barbara J. Rothstein, *Mr. Warren I. Scholl, Mr. and Mrs. Walter Sprague, Mrs. LaVerne Strasburger, Mrs. Frank Stronecker, Mrs. J.R. Swayne, Mrs. Arthur R. Taylor, Mrs. Richard Thompson, Mrs. Grace Travis, Mrs. John G. Tubitt, Mrs. Michael Vranesh, Mrs. Jean Wakefield, Mrs. Gale Wald, Miss Zandra Walker, *Mrs. F.E.W. Ward, Mrs. John N. Wilkinson, *Mr. Stephen Worthy.

We are also grateful to the following who have increased their dues to:

Sponsor — Harold G. King. *Contributing* — Charles W. Bingham, Mrs. John W. Ormsby, Mrs. W. Lowell Reed. *Sustaining* — Mrs. Fred G. Clarke, Mrs. Fay C. Snyder, Mrs. Olive E. Staats, Ms. J.E. Stewart, Mrs. E.W. Stuchall.

*Joined through the Plant Sale

University of Washington Classes

Spectrum, the quarterly journal for Continuing Education, is sent free to those who have indicated interest in the University of Washington's night courses, adult education classes, concerts and other cultural activities. Those who wish to obtain early notice of such classes are urged to place their names on its mailing list by calling 543-2590.

Arboretum Courses

FALL TOURS. Tours of the Arboretum grounds in fall color. Instructor: Joseph Witt. Class limited to 20; meet at Arboretum office. Saturdays, Oct. 1, 15, 29; 10-12 noon. 3 sessions, $5.

IDENTIFICATION OF NATIVE TREES AND SHRUBS. Field class covering 40 species of common trees, shrubs and ferns native to western Washington. Instructor: Pat Duxler. Class limited to 15; meet at Arboretum office. Saturdays, Oct. 1 thru 22; 10-12 noon. 4 sessions, $10.

BASIC GARDEN MAINTENANCE. Basic gardening techniques including soil preparation, planting, fertilizing, mulching and seasonal care of plants. Instructor: Chico Narro. Class limited to 15; Arboretum greenhouse. Saturdays, Oct. 1 thru Nov. 5; 10-12 noon. 6 sessions, $15.

PRUNING ORNAMENTALS. Techniques of pruning trees and shrubs. This is an outdoor demonstration class; appropriate clothing and waterproof footwear are recommended. Instructor: Chico Narro. Class limited to 30; meet at Arboretum greenhouse. Saturdays, Nov. 12 & 19; 10-12 noon. 2 sessions, $5.

For further information, call 543-2730. To register, make check payable to the University of Washington and send to: Arboretum Courses, Anderson Hall (AR-10), University of Washington, Seattle, WA 98195.

Continuing Education

THE LIVING FOREST. Lecture series about the northwest forest. Coordinator: Prof. Fiorenzo Ugolini, College of Forest Resources. Thursday nights, October 6-December 1; 7:30-9:30. 8 sessions, $20.

NATURAL HISTORY OF INSECTS. Introduction to insects of all kinds. Instructor: Prof. Mark Deyrup, Zoology Department. Wednesday nights, October 5-December 7; 7:30-9:30. 10 sessions and 3 field trips (UW campus, Arboretum and Seward Park), $40.

IDENTIFYING MUSHROOMS OF THE PACIFIC NORTHWEST. Instructor: Prof. Daniel Stuntz, Botany Department. Mostly Monday nights, September 26-November 28; 7:30-10:00. 10 sessions, $40.

THEORY AND TECHNIQUE OF PRACTICING ENERGY CONSERVATION. Practical applications, motivations to conserve and an energy audit of your house. Instructor: Prof. Marvin Olsen, Sociology Department. Guest speakers will include Prof. William Brewer, Environmental Studies. Monday nights, October 3-November 21; 7:30-9:30. 8 sessions, $30.

To register, obtain a free copy of *Spectrum* which has full information and registration forms. Call 543-2590.

ARBORETUM STAFF

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THE ARBORETUM FOUNDATION

STATEMENT OF CASH RECEIPTS, DISBURSEMENTS
AND CHANGES IN CASH BALANCES

YEAR ENDED APRIL 30, 1977

	Unrestricted	Restricted	Building Fund	Endowment Trust Fund (Note 4)	Total all funds
Receipts:					
Dues	$ 23,285				$ 23,285
Donations	3,330				3,330
Unit Council-					
Plant and bulb sales	48,537				48,537
Other	2,925				2,925
Interest on savings and investments	24,814	$ 248	$ 8,511		33,573
Income from investment trust				$1,007	1,007
Advertising and miscellaneous	4,610				4,610
	107,501	248	8,511	1,007	117,267
Disbursements:					
Salaries and wages	16,774				16,774
Payroll taxes	1,557				1,557
Bulletin and publication	22,805				22,805
Publicity	2,771				2,771
Other operating expenses	10,876			400	11,276
Unit Council expenses-					
Plant and bulb sales costs and expense	24,382				24,382
Utilities, supplies and postage	6,450				6,450
Donations to University of Washington Arboretum	20,127				20,127
Donations to Japanese Garden	25,000				25,000
Donation to Memorial Gates	3,165				3,165
Donation to frost hardiness study	5,000				5,000
Net advances to University of Washington Press (Note 2)	12,000				12,000
	150,907			400	151,307
Excess (deficit) of receipts over disbursements	(43,406)	248	8,511	607	(34,040)
Transfer of Endowment Fund income	1,801			(1,801)	-
Cash balance at April 30, 1976	463,828	3,938	136,623	1,294	605,683
Cash balance at April 30, 1977	$422,223	$4,186	$145,134	$ 100	$571,643

The above audit is on file in the Foundation office with explanatory notes.

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Photo: William Eng

A branch of *Sorbus anglica* with clusters of bright red fruit.

Fruits in red and orange, white, yellow,
pink and even black
Leaves in shades of yellow, orange and
a multitude of reds
The subtle blending of colors in
the Japanese Garden

Join the Explorers' Walks on September 28, October 26 and November 23, meeting at 10 a.m. in the parking lot of the administration buildings.